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NUCLEAR SCIENCE ABSTRACTS

January 15, 1958

Volume 12 Number 1
Abstracts 1-700

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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GENERAL

Atomic Bombs and Warfare

Refer also to abstract 45.

1

THE ATOMIC BOMB. A PHOTOGRAPHIC RECORD. Japan, Shinshico-Sha, 1957. 201p. (In English and Japanese)

Atomic Power

Refer also to abstract 593.

2 AERE-CE/M-193

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME THOUGHTS ON THE INDUSTRIAL USE OF HEAT FROM NUCLEAR REACTORS. C. M. Nicholls. Jan. 3, 1957. 21p.

Limitations and possibilities of using nuclear reactors to provide the heat for industrial processes are discussed. The temperatures that can be achieved in nuclear reactors will govern the processes that can be considered while the scale of the unit installations will control the economics. (auth)

3 CRNE-726

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

REACTOR SAFETY STANDARDS AND THEIR ATTAINMENT. E. Siddall and W. B. Lewis. Sept. 13, 1957. 27p. (AECL-498).

An economic evaluation of nuclear power plant hazards and safety measures is presented and compared with other industrial operations. (D.E.B.)

4 TID-3510

Technical Information Service Extension, AEC.

ECONOMICS OF NUCLEAR POWER. A LITERATURE SEARCH. Richard J. Smith, comp. July 1957. 8p. $0.15(OTS).

5

CONTROLLED ENERGY PRODUCTION FROM NUCLEAR FUSION. Georg Weiss. Die Atomwirtschaft 2, 276-9(1957) Sept. (In German)

6

POWER REACTORS. 1. THE GOVERNMENT VIEW. W. Kenneth Davis, Louis H. Roddis, Jr., and Clark Goodman (U. S. Atomic Energy Commission, Washington). Nucleonics 15, No. 9, 90-3(1957) Sept.

Problems, plans, and probabilities in the field of nuclear power development in the United States are discussed. The civilian-power-reactor program of the Atomic Energy Commission is reviewed. (C.H.)

7

POWER REACTORS. 2. ECONOMIC TRENDS. Chauncey Starr (North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 9, 94-9(1957) Sept.

The development of reactors for power production is reviewed. Predictions are made as to future developments. (C.H.)

8

POWER REACTORS. 4. OUTLOOK FOR UTILITIES. Philip Sporn (American Gas and Electric Co.). Nucleonics 15, No. 9, 104-7(1957) Sept.

Economic factors affecting the development of competitive systems of energy generation utilizing nuclear fuels are discussed. It is predicted that for a long time to come operating costs of atomic power plants will be higher than those of conventional plants. (C.H.)

9

SHIP PROPULSION. Richard P. Godwin (U. S. Atomic Energy Commission). Nucleonics 15, No. 9, 114-17(1957) Sept.

In 1956 the Maritime Administration and the Atomic Energy Commission initiated a program to carry forward the construction of the first nuclear-powered merchant ship. Between 1960 and 1965 between five and ten experimental nuclear-powered merchant vessels will be built or building. Design, safety, and economic factors are reviewed. (C.H.)

Research Programs

10 NP-6396

Argentina. Ministerion de Marina. Dirreción General de Navegación e Hidrografía.

INTERNATIONAL GEOPHYSICAL YEAR OCEANOGRAPHIC PROGRAM OF THE ARGENTINE REPUBLIC. Luis R. A. Capurro. 1956. 6p.

A condensation in English of: Año Geofísico Internacional Oceanographía Física Programa de la República Argentina.

BIOLOGY AND MEDICINE

11

USE OF RADIOISOTOPES IN MEDICINE. W. I. Modestow. Atomkern Energie 2, 97-101(1957) Mar. (In German)

Radiation Effects

12 AF-SAM-57-116

Texas. Univ., Houston. M. D. Anderson Hospital and Texas. Univ., Houston. Tumor Inst.

CHANGE IN PLASMA CLEARANCE RATE AND RED CELL UPTAKE OF RADIOACTIVE IRON IN PATIENTS FOLLOWING TOTAL-BODY X-RADIATION. W. K. Sinclair. Apr. 12, 1957. 7p.

Data are presented on changes in plasma clearance half-time and red cell uptake of Fe^{59} in 12 patients irradiated with x rays at a nominal air dose of 200 r, corresponding to an average dose of 130 rads. These data show a maximum change occurring at 3 to 4 days after irradiation which lengthens the plasma clearance half-time to double or triple its previous value. A slight but definite depression, of the order of 10% on the average, is demonstrated in the red cell uptake. (auth)

13 NP-6440

Czechoslovakia.
INFORMATION SUBMITTED BY CZECHOSLOVAKIA. Note by the Secretary-General [on Effects of Atomic Radiation. Includes also Review of Studies of Natural Radioactivity of Water, Air and Soil in the Czechoslovak Republic]. Sept. 20, 1956. 45p.

Proposed topics for discussion by the United Nations General Assembly Scientific Committee on the Effects of Atomic Radiation include the status of studies on the genetic hazard and the present status of studies on, and the measurements of, the biological effects of small doses of radiation. Studies on the natural radioactivity of water, air, and soil in the Czechoslovak Republic are reviewed. No systematic research has been carried out. Available data are presented in tabular form. (C.H.)

14 UR-494

Rochester, N. Y. Univ. Atomic Energy Project.
STUDIES ON LARGE AREA SUB-FABRIC BURNS. K. M. Berkley and H. E. Pearse. July 5, 1957. 19p. Contract W-7401-eng-49. $0.75(OTS).

15 USNRDL-TR-165

Naval Radiological Defense Lab., San Francisco.
ELECTROLYTE EXCRETION IN THE RAT FOLLOWING SEVERE INTESTINAL DAMAGE BY X IRRADIATION. K. L. Jackson, R. L. Rhodes, and C. Entenman. June 20, 1957. 25p. Project NM-006-015.04.

16 USNRDL-TR-167

Naval Radiological Defense Lab., San Francisco.
NEOPLASMS OF THE GLANDULAR STOMACH IN MICE IRRADIATED WITH X RAYS OR FAST NEUTRONS. P. C. Nowell, L. J. Cole, and M. E. Ellis. May 21, 1957. 24p. Project NM-006-015.04.

17 USNRDL-TR-172

Naval Radiological Defense Lab., San Francisco.
THE ROLE OF FOOD CONSUMPTION IN THE MORTALITY RESPONSE OF IRRADIATED RATS SUBJECTED TO PROLONGED COLD EXPOSURE. B. D. Newsom and D. J. Kimeldorf. May 21, 1957. 15p. Projects NM 006-015 and BuMed 62-93-60.

18 UWFL-42

Washington. Univ., Seattle. Applied Fisheries Lab.
A RADIOLOGICAL STUDY OF RONGELAP ATOLL, MARSHALL ISLANDS, DURING 1954–1955. Aug. 15, 1955. 75p. Contract AT(45-1)540. $2.00(OTS).

The detonation of shot one at Bikini Atoll on March 1, 1954, produced a fallout of radioactive ash upon Rongelap Atoll, Marshall Islands. The distribution of the radioactive ash on the islands and in the plants and animals of the area has been studied and evaluated. During the first expedition to Rongelap Atoll on March 26, 1954, biological samples were collected and measurements made of the radiation contamination. On three additional expeditions extensive collections of material were made for this study, the last on January 25-30, 1955. The decline in radioactivity was measured in 1499 samples of fish, invertebrates, land plants, algae, birds, plankton, soil, and water from the Rongelap area. During this study particular emphasis was placed upon evaluation of the radioactivity in food used by the natives. Coconut milk collected on March 26, 1954, contained 1.03 microcuries per kilogram of wet tissue while the coconut meat had 1.16 $\mu c/kg$. By January 25-30, 1955, the level in coconut milk had declined to 0.041 $\mu c/kg$ and the meat to 0.036 $\mu c/kg$. Fish muscle on March 26, 1954, averaged 2.74 $\mu c/kg$ and fish liver 204.0 $\mu c/kg$. The decline to January 25-30 was 0.10 $\mu c/kg$ for the muscle and 3.52 $\mu c/kg$ for the liver of fish. Somewhat similar declines were found for clam muscle, crab muscle, bird muscle and liver, and for squash, papaya, arrowroot and pandanus. The level of radioactivity was highest in the northern portion of the atoll, except for samples of algae and fish-eating birds, collected during January 1955 from the southern part of the atoll, which had higher levels of radioactivity than samples collected from the northern islands on the same date. This may indicate a translocation of radioactive materials within the lagoon. (auth)

19 AEC-tr-3046

ON THE METHODS OF FINDING CHANGES ARISING IN THE ORGANISM UNDER THE INFLUENCE OF SMALL DOSES OF IONIZING RADIATION. Draft Translation of U.S.S.R. Report. [1956?]. 10p.

20

SOME PHYSICAL ASPECTS OF RELATIVE BIOLOGICAL EFFICIENCY. P. R. J. Burch (Univ. of Leeds). Brit. J. Radiol. 30, 524-9(1957) Oct.

After surveying the broad nature of the problem of relative biological efficiency, an account is given of methods which have been used to characterize the quality of ionizing radiations. These former methods have ignored the phenomenon of secondary or δ-track formation and reference is made to treatments which take this factor into account. The concept of local energy losses is defined, and tables are given for various radiations, showing the amounts of local energy dissipated in water with respect to particle kinetic energy range. The radiations considered are 1 Mev and Po^{210} α particles, tritium β particles, 1 and 2 Mev monochromatic electrons, 25 Mvp, 220 and 100 kvp x rays and Co^{60} γ rays. The special problem of the LET of electrons of less than 2 kev is considered and new values are derived from recently published experimental results. A mean LET is defined and calculated; its limitations are emphasized. (auth)

21

EFFECT OF TOTAL BODY IRRADIATION ON IRON METABOLISM IN HUMAN BONE MARROW. H. D. Suit, F. Ellis, and R. Oliver (Churchill Hospital, Oxford). Brit. J. Radiol. 30, 553-9(1957) Oct.

Results of hematological and iron metabolism investigations on 17 patients who received total body x irradiation are presented. In vivo iron tracer studies indicate that 25 to 50 r total body irradiation to man 24 hours before an injection of Fe^{59} does not delay the appearance of the radioactive iron in the peripheral erythrocytes. One hundred röntgens total body irradiation to man does not delay the appearance of Fe^{59} in the peripheral erythrocytes if the tracer is given two hours after the irradiation, but if the tracer is given 24 to 72 hours after irradiation there is a definite delay in the appearance of the Fe^{59} in the erythrocytes. The probable mechanisms for producing the delay in the appearance of the Fe^{59} in the peripheral erythrocytes are discussed. (auth)

22

PHYSIOLOGICAL EFFECTS OF γ RAYS ON THE CORTEX OF CEREBRAL HEMISPHERES. Z. V. Denisova (Sechenov Inst. of Evolution Physiology.). Med. Radiol. 2, No. 4, 3-11(1957) July-Aug. (In Russian)

Experiments with dogs showed the early suseptibility of the cortex of cerebral hemispheres to low doses of ionizing radiation. After irradiation a certain weakening of the inhibitory process in the higher nervous activity of the animals was observed. (R.V.J.)

23

GAMMA RADIATION EFFECTS ON REPRODUCTION OF WHITE RATS AND THEIR PROGENY. A. I. Osipovskii (Moscow Order of Lenin Med. Inst.). Med. Radiol. 2, No. 4, 30-8(1957) July-Aug. (In Russian)

Various changes were observed in the sexual cycles of rats exposed to single doses of 198, 360, or 520 r. The rhythm of their sexual cycle was disturbed and dioestrum greatly prolonged. After irradiation by 500 r the sexual life was completely interrupted. Anomalies of the skeleton, of skin derivatives, of vestibular apparatus, and dwarfism were observed in rats born to irradiated rats in the first and second generations. (R.V.J.)

24

CONDITION OF THE CORTEX IN SUPRARENAL GLANDS DURING RADIATION SICKNESS. L. V. Bozhenko (Central Research Roentgen-Radiological Inst. of Ministry of Health, U.S.S.R.). Med. Radiol. 2, No. 4, 44-50(1957) July-Aug. (In Russian)

An active excretion of ascorbic acid was observed during the first hours after x irradiation with 300, 600, and 1500 r. Later the condition of the suprarenal changed according to the gravity of the pathological process. In subacute forms of radiation sickness (300 to 600 r), the process passed three stages: the period of enhancement, of depression, and of normalization. In the acute form (1500 r) the function of the suprarenal cortex was depressed during the whole period of radiation sickness. (tr-auth)

25

EFFECTS OF PRELIMINARY IRRADIATION ON DEVELOPMENT OF ANTI-TOXIC ANTIDIPHTHERIC IMMUNITY. D. R. Kaulen (Gamalei Inst. of Epidemology and Microbiology). Med. Radiol. 2, No. 4, 57-8(1957) July-Aug. (In Russian)

It was found that preliminary irradiation decreases the natural resistance of animals; however, double immunization given to guinea pigs not only restored their normal degree of resistance but, also, created a certain degree of natural immunity. This immunity, however, is much lower than in normal animals. (tr-auth)

26

CHANGES IN THE HARD TOOTH TISSUES AFTER MULTIPLE EXPOSURES TO SMALL DOSES OF IONIZING RADIATION. A. A. Prokhunchukov (Moscow Medical Stomatological Inst.). Med. Radiol. 2, No. 4, 74-7(1957) July-Aug. (In Russian)

The hard tissues of rat's teeth exposed 25 to 36 times to small doses of x radiation (25 r) were studied with the aid of radioactive isotopes of P^{32} and Ca^{45}. It was revealed that the changes in phosphorus–calcium metabolism depends on the total doses of irradiation. After a total dose of 700 r the phosphorus–calcium metabolism is activated in the hard tissues of teeth and with 900 r it becomes pronounced. (tr-auth)

27

THE EFFECTS OF IONIZING RADIATION ON PLANTS: BIOCHEMICAL AND PHYSIOLOGICAL ASPECTS. Solon A. Gordon (Argonne National Lab., Lemont, Ill.). Quart. Rev. Biol. 32, 3-14(1957) Mar.

28

THE EFFECT OF IONIZING RADIATION ON CHROMOSOMES. Karl Sax (Harvard Univ., Cambridge, Mass.). Quart. Rev. Biol. 32, 15-26(1957) Mar.

29

GENETIC EFFECTS OF RADIATION ON HIGHER PLANTS. Calvin F. Konzak (Brookhaven National Lab., Upton, N. Y.). Quart. Rev. Biol. 32, 27-45(1957) Mar.

30

THE EFFECTS OF IONIZING RADIATION ON PLANTS: MORPHOLOGICAL EFFECTS. James E. Gunckel (Rutgers Univ., New Brunswick, N. J. and Brookhaven National Lab., Upton, N. Y.). Quart. Rev. Biol. 32, 46-56(1957) Mar.

31

A RELATION OF NUCLEIC ACID SYNTHESIS TO RADIATION-INDUCED MUTATION FREQUENCY IN BACTERIA. F. L. Haas and C. O. Doudney (Univ. of Texas and M. D. Anderson Hospital and Tumor Inst., Houston, Texas). Proc. Natl. Acad. Sci. U. S. 43, 871-83(1957) Oct.

32

EFFECTS OF GAMMA RAYS ON VARIOUS IMMUNITY FACTORS. J. Coursaget and G. Gaude. Rev. franc. etudes clin. et biol. 1, No. 6, 643-51(1956). (In French)

Total body irradiation of guinea-pigs with gamma irradiation from Co^{60} does not affect the phenomenon of phagocytosis as studied in vitro, although the same irradiation results in severe haematological disorders. Similar irradiation at doses equal to or greater than 400 r, considerably reduces the level of serum antibodies if the antigen is injected later than at least six hours after the irradiation. (auth)

33

MEDICAL RADIATION BIOLOGY. Friedrich Ellinger. Springfield, Charles C. Thomas, 1957. 974p.

The fundamentals of radiation biology, the biology of ionizing radiations, the biology of ultraviolet radiation, and photobiology are discussed in detail. 4600 references. (C.H.)

Radiation Hazards and Protection

Refer also to abstracts 89, 401, and 428.

34 AD-125592

Army Medical Nutrition Lab., Denver.

ACCEPTABILITY OF IRRADIATED FOOD CONSUMED BY HUMAN SUBJECTS. Report 200. Virginia E. McGary, Margaret E. Shipman, Lester M. Levy, and Lionel M. Bernstein. Mar. 15, 1957. 23p. Project 6-60-11-020.

Irradiated foods were fed to nine or ten human test subjects in four separate studies. In the first study irradiated foods provided approximately 35% of the total calorie intake; in the second, 61%, in the third, 80%; and in the fourth study, 100%. Acceptability data were obtained by use of questionnaires with an arbitrary hedonic scale, and by personal interviews with the individual subjects. Statistical analysis of the acceptability data showed significant differences between irradiated and control food in only 10 out of 42 items. Control foods were preferred to irradiated foods in nine of the 10 cases. (auth)

35 CRHP-733

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

EMERGENCY RADIATION MONITORING OF DRINKING WATER. G. W. C. Tait and W. F. Merritt. Oct. 1957. 20p. (AECL-505).

A simple method using standard radiation survey meters is proposed for monitoring drinking water against bomb fall-out. The gamma field associated with a suitable volume of water is measured and compared with the fields expected from permitted concentrations of fission products of known age. The fields produced by these permitted concentrations have been tabulated, and the concentrations are themselves chosen consistent with British and U. S. recommendations. The validity of the technique is examined from a number of points of view and has been checked by experimental studies. The method is generally applicable whether or not water treatment has been undertaken. Recommendations are summarized. (auth)

36 IGRL-IB/R-21

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

GENERAL HEALTH PHYSICS. Information Bibliography. Sept. 1957. 12p.

This is a selection of report, book and journal references to publications issued up to December, 1956. Sources used were U.K., Canadian, and U.S. reports abstracts, Nuclear Science Abstracts, Geneva Conference (1955) papers, Engineering Index (1950-1955), and Industrial Arts Index (1956). (auth)

37 IGRL-IB/R-26

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

HEALTH PHYSICS MONITORING INSTRUMENTS AND METHODS. Information Bibliography. Sept. 1957. 20p.

This is a selection of report, book, and journal references to publications issued up to December, 1956. Sources used were U.K., Canadian, and U.S. report abstracts, Nuclear Science Abstracts, Geneva Conference (1955) papers, Engineering Index (1950-1955), and Industrial Arts Index (1956). (auth)

38 NYO-4753(Suppl. 1)

New York Operations Office, AEC.

ANNOTATED BIBLIOGRAPHY ON LONG RANGE EFFECTS OF FALLOUT FROM NUCLEAR EXPLOSIONS. Allen G. Hoard, Merril Eisenbud, and John H. Harley. Nov. 1956. 18p. $0.20(OTS).

This bibliography is limited to published articles and speeches concerning the various aspects of radiation effects resulting from fall-out of nuclear explosions. Although some articles reflect instrumentation as used in respect to measuring the effects of fall-out, no major attempt was made to include the field of instrumentations. See also NYO-4753. (auth)

39 RFP-85

Dow Chemical Co. Rocky Flats Plant, Denver.

INTEGRATED AIR SAMPLING PROGRAM FOR A RADIOACTIVE PLANT. T. S. Chapman. June 17, 1957. 13p. Contract AT(29-1)-1106. $3.30(ph OTS); $2.40(mf OTS).

40 USNRDL-TR-181

Naval Radiological Defense Lab., San Francisco.

THE EFFECT OF X-RAY DOSE ON THE PROTECTIVE ACTION AND PERSISTENCE OF RAT BONE MARROW IN IRRADIATED MICE. G. W. Santos, L. J. Cole, and P. L. Roan. Sept. 12, 1957. 20p. Project NM-006-015.

Rat bone marrow cell suspensions were injected intravenously into x-irradiated mice, with the addition of penicillin to the suspending medium. Various radiation dose levels in the midlethal, lethal, and supralethal range were employed (600 to 1000 r). This study shows that penicillin treatment on the day of irradiation significantly improved the 30-day survival of the rat marrow-treated mice, but not the 60-day survival. Treatment with rat bone marrow lowered the 30- and 60-day mortality (except at the 3 lowest doses, 600, 640, and 680 r, where there was no significant difference in mortality) as compared with control-irradiated mice injected with penicillin only. The 30-day mortality in rat marrow-treated mice was relatively constant, approximately 20 percent up to 870 r; at 1000 r mortality was 80 percent. The time of persistence of rat white blood cells, as detected by the alkaline-phosphatase reaction, was dose dependent up to 870 r, suggesting that the x-irradiated mouse is capable of recognizing and disposing of these foreign cells. The possible basis for difference between the present results and those of recent reports from other laboratories has been discussed. (auth)

41 UWFL-47

Washington. Univ., Seattle. Applied Fisheries Lab.

SURVEY OF RADIOACTIVITY IN THE SEA AND IN PELAGIC MARINE LIFE WEST OF THE MARSHALL ISLANDS, SEPTEMBER 1-20, 1956. Allyn H. Seymour, Edward E. Held, Frank G. Lowman, John R. Donaldson, and Dorothy J. South. Mar. 15, 1957. 63p. Contract AT(45-1)-540. $1.75(OTS).

A survey of the radioactivity in the sea in the region of the North Equatorial Current from the Marshall Islands to the Marianas Islands was made in September 1956. Plankton samples were taken by oblique tows from 200 meters and water samples were taken from the surface, 25, 50, 100, and 150 meters at 74 stations. The general pattern of distribution of radioactivity shows a sharp decrease east of Bikini and a gradual but irregular decrease west of Eniwetok. A slight degree of contamination is indicated as far to the west as Guam, the western extremity of the survey. Non-fission products account for a large proportion of the radioactivity in plankton and fish samples. (auth)

42

GAMMA-RAY PROTECTION ON THE "THERATRON" COBALT UNIT. D. E. A. Jones (Mount Vernon Hospital, Northwood, Middlesex). Brit. J. Radio. 30, 550-2(1957) Oct.

43

EFFECTS OF RADIOACTIVE COBALT ON THE RESISTANCE OF THE ORGANISM TO IONIZING RADIATION. L. A. Dimitrov (Med. Inst. of Sofia, Bulgaria). Med. Radiol. 2, No. 4, 11-18(1957) July-Aug. (In Russian)

Conclusions on experiments with dogs exposed to lethal doses showed that Co^{60} introduced intravenously before the exposure gives a certain protection against radiation sickness. Changes observed in the suprarenal cortex reflect the general condition of the body. (R.V.J.)

44

REACTOR SAFETY. C. Rogers McCullough (U. S. Atomic Energy Commission). Nucleonics 15, No. 9, 134-6(1957) Sept.

Since its formation, the Atomic Energy Commission has been concerned with the reactor safety program. Activities are reviewed, and it is predicted that the future holds safer reactors. It is predicted there will be more emphasis on government regulation and industry standardization. (C.H.)

45

RADIATION: WHAT IT IS AND HOW IT AFFECTS YOU. Jack Schubert and Ralph E. Lapp. New York, The Viking Press, 1957. 314p.

The biological effects of radiation due to fall-out following nuclear explosions are discussed. (C.H.)

46

PROBLEM OF RADIATION PROTECTION IN THE PEACEFUL APPLICATION OF ATOMIC ENERGY. Robert G. Jaeger. Z. angew. Phys. 9, 467-79(1957) Sept. (In German)

Radiation Sickness

47

ON DISTURBANCE OF PIGMENT METABOLISM IN RADIATION SICKNESS. A. E. Ivanov. Med. Radiol. 2, No. 4, 18-23(1957) July-Aug. (In Russian)

Brownish pigment consisting of minute granules is frequently found in the tissues of irradiated animals. Evidently increased hemolysis of erythrocytes and their destruction takes place in the areas of hemorrhages resulting from irradiation. However, due to disturbed function of reticulo-endothelial cells and depression of

erythropoiesis the iron is not utilized for erythrocytes and bile pigments; thus it accumulates in tissues in a form of brownish pigment in which iron is found in colloidal form. (tr-auth)

48

ON HEALING PROCESSES IN TISSUES DAMAGED BY X RADIATION. I. V. Shiffer (Central Research Roentgen-Radiological Inst. of Ministry of Health, U.S.S.R.). Med. Radiol. 2, No. 4, 38-43(1957) July-Aug. (In Russian)

49

ON THE CHARACTERISTIC FEATURES OF BRESLAU PARATYPHOID COMBINED WITH RADIATION SICKNESS IN MONKEYS. L. A. Yakovleva, B. A. Lapin, et al. (Sukhrim Medico-Biological Station). Med. Radiol. 2, No. 4, 58-65(1957) July-Aug. (In Russian)

Progressive leukopenia is a specific feature in the course of combined diseases. Preliminary specific immunization prevents the development of paratyphoid and decreases death among the infected animals. X irradiation with 400 r destroys the previously created artificial immunity while irradiation with 250 r is not able to destroy it. (tr-auth)

50

PATHOLOGICAL ANATOMY OF LESIONS DUE TO La^{140}. V. N. Strel'tsova. Med. Radiol. 2, No. 4, 78-83(1957) July-Aug. (In Russian)

Pathological morphology of lesions due to intravenous or intraperitoneal injection of La^{140} was studied. In chronic radiation sickness due to La^{140} a peculiar subacute hepatitis was observed in 40% and with cirrhosis in 20% of all treated rats. Large slowly healing ulcers were found in the appendix, in the intestine, and in the rectum. Malignant and benign tumors appeared on the skin or on the liver in 35% of the cases. A short acute stage followed by almost complete recovery was typical even in acute cases of radiation lesions caused by La^{140}. Pathological-anatomical changes caused by La^{140} are identical to those produced by Ce^{144} and Pm^{147}. (tr-auth)

Radiotherapy

Refer also to abstracts 413 and 414.

51 ORINS-17

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
ISOTOPES IN MEDICINE—ARE THEY WORTH THE TROUBLE? Marshall Brucer. May 1, 1957. 41p. Contract AT-40-1-GEN-33. $0.30(OTS).

52

PROTON IRRADIATION OF THE PITUITARY. John H. Lawrence (Univ. of California, Berkeley). Cancer 10, 795-8(1957) July-Aug.

Observations on 26 patients indicate that it is possible to destroy the pituitary gland by proton beam irradiation. (C.H.)

53

STUDIES WITH RADIOIODINE. VI. EVALUATION OF RADIOIODINE TREATMENT OF CARCINOMA OF THE THYROID BASED ON THE EXPERIENCE AT THE UNIVERSITY OF CALIFORNIA FROM 1938 TO 1954. Glenn E. Sheline and Earl R. Miller (Univ. of California School of Medicine, San Francisco). Radiology 69, 527-45(1957) Oct.

Between September 1945 and June 30, 1954, 124 patients with histologically proved primary carcinoma of the thyroid gland were studied. Only patients with residual inoperable neoplastic tissue were accepted for I^{131} treatment, and, as a rule, they were treated only after the establishment of some degree of radioiodine uptake of the neoplastic tissue. In most cases the aim was to administer 100 millicuries of I^{131} per month as long as evidence of tumor avidity for I^{131} could be shown. In these cases total doses of several hundred millicuries were given, distributed over several months. Results are summarized. Selected case histories are included. (C.H.)

Toxicology Studies

Refer also to abstract 94.

54 TID-451

Technical Information Service, AEC.
BIBLIOGRAPHY ON METABOLISM AND TOXICOLOGY OF INTERNALLY DEPOSITED ELEMENTS AND THEIR ISOTOPES. Robert L. Shannon. Jan. 15, 1951. Decl. Sept. 18, 1957. 31p. $4.80(ph OTS); $2.70(mf OTS).

A guide is presented to Atomic Energy Commission literature on the metabolism or toxicology of 57 elements of interest. A number of tracer studies are included. Studies employing U, Ra, Pu, and Po are omitted. (C.H.)

Tracer Applications

Refer also to abstract 423.

55 UR-495

Rochester, N. Y. Univ. Atomic Energy Project.
THE DISTRIBUTION AND EXCRETION OF POLONIUM^{210} AFTER INHALATION. H. L. Berke and A. C. DiPasqua. May 31, 1957. 42p. Contract W-7405-eng-49. $7.80 (ph OTS); $3.30(mf OTS).

Rats have been exposed in a specially designed inhalation chamber to a controlled NaCl aerosol contaminated with small amounts of Po^{210} (3.17×10^{-6} μc/ml air, geometric mean diameter 0.098 μ, σ g 1.81). About 53% of the inhaled aerosol was deposited in the animal, equally divided between the lung-trachea and the gastrointestinal tract after five hours exposure. About 20% of the total Po^{210} deposited in the respiratory tree was cleared during this time. The rate of post exposure lung clearance was exponential with time and quite rapid during the first 30 days (10 day half-time), slower and less regular at later times. The tissue distribution after inhalation is different from that observed after the intravenous, oral or intratracheal route of entry as seen particularly in blood and spleen. Total excretion was lower following inhalation than that after intratracheal or intravenous administration. An intermediate value of 6:1 was observed for the ratio of fecal to urinary Po^{210}. It is concluded that the distribution and excretion of Po^{210} in the rat after an inhalation exposure represents a balance between that observed after intratracheal injection and that after the oral route of entry. (auth)

56 UR-502

Rochester, N. Y. Univ. Atomic Energy Project.
THE TRANSPORT OF BIVALENT CATIONS INTO THE YEAST CELL IN RELATION TO POTASSIUM AND PHOSPHATE UPTAKE. Aser Rothstein. July 15, 1957. 21p. Contract W-7405-eng-49. $3.30(ph OTS); $2.40(mf OTS).

57

RETENTION AND TOXICITY OF RADIOSTRONTIUM IN MONKEYS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/142. A. H. Ward. London, Pergamon Press, Ltd., 1957. 9p.

Experiments with Sr^{90} administered to monkeys from a colony of 80 animals are described. Single doses, ranging from 1 to 0.001 mg/kg bodyweight were given to animals in three experimental groups distributed amongst three species. Relations between survival time and injection

dose are discussed, and the lethal dose for 30 and 500 days estimated at 0.70 and 0.01 mc/kg bodyweight respectively indicates a higher toxicity in monkeys than in any other animal yet reported. A marked species difference is seen in the toxicity of low injection doses. Excretion and retention of Sr^{90} and Y^{90} are discussed. (auth)

58

EXPERIMENTS ON THE MATABOLISM OF CERTAIN FISSION PRODUCTS IN DAIRY COWS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/143. Helen M. Squire, L. J. Middleton, B. F. Sansom, and C. R. Coid. London, Pergamon Press, Ltd., 1957. 13p.

Dairy cows have been fed with separated carrier free I^{131}, Sr^{89}, Te^{132} and Ru^{106}. The amounts of these isotopes recovered from the milk, urine and feces, and their rates of secretion and excretion, have been measured; estimates have also been made of the amounts retained in the body. Nineteen administrations of iodine have been made, twelve of strontium, five of tellurium and one of ruthenium. Wide variations in the amounts of I^{131} and Sr^{89} secreted into the milk have been observed. These were partly due to the variations in milk yield. Similar experiments have been carried out with fission products collected from trials of atomic weapons. There was no apparent difference between the metabolism of the fission products from the two sources. (auth)

CHEMISTRY

59 AECD-3638

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

THE ACTION OF OXYGEN ON ACTIVATED CHARCOAL. J. E. Bigelow, M. W. Belaga, R. J. Mulvihill. June 29, 1951. Decl. July 8, 1957. 10p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26]. (KT-107). $3.30(ph OTS); $2.40(mf OTS).

It has been proposed that O_2 be introduced into a homogeneous reactor to maintain an oxidizing atmosphere under which the system is more stable. In this case, the excess O_2 would pass through the adsorbing bed along with the Xe. However, the action of almost pure O_2 on a bed of charcoal was unknown. It was the purpose of this project to ascertain the effect of O_2 on activated charcoal at approximately one atmosphere by measuring the amount of CO_2 formed over a known length of time. (auth)

60 AECU-3500

Oregon. Univ., Eugene.

FORMATION FIELDS AND CURRENT EFFICIENCIES IN THE ANODIC OXIDATION OF ZIRCONIUM: A DIRECT COMPARISON OF HIGH-POTENTIAL FORMATION FIELDS WITH THOSE DERIVED FROM LOW-POTENTIAL CHARGING CURVES. George B. Adams, Jr., Tien-Shuey Lee, and Pierre Van Bysselberghe. [1957]. 34p. Contract [AT(45-1)-535]. $0.30(OTS).

Formation fields at selected constant currents were obtained from high-potential unitary formation rates and polarographic current efficiency measurements carried out over the potential range, 20 to 130 volts. These values are compared with formation fields derived from low-potential unitary formation rates alone, in the potential range below 2 v. Results are reported for abraded Kroll process metal at 750 $\mu a/cm^2$, for abraded and for chemically polished iodide process metal at 100 and 750 $\mu a/cm^2$ and 100 $\mu a/cm^2$, respectively. Ionic current efficiencies are reported for several current densities in the high-potential range and for the low-potential localized oxygen evolution process. (auth)

61 AERE-CE/R-2158

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SODIUM–STEAM REACTION EXPERIMENTS. W. B. Woollen, D. Scott, and F. R. Dell. Oct. 1956. 19p.

In view of the apparent complexity of the reaction between Na and steam, a large-scale experiment was devised as a climax to a number of early bench experiments, in order to simulate as closely as possible the effect of a small steam leak into Na in a Na/superheated steam heat exchanger. The reaction resulting from passing superheated steam through a $^3/_{32}$-in.-diam. hole into 44.8 lb of Na at temperatures of 450°C down to 282°C in the presence of Ar proceeded smoothly and inaudibly without any marked change of either temperature or pressure. Hydrogen was present in the gas and was given off as soon as the reaction commenced, but no O_2 or steam was detected. In a subsequent test dry Ar was passed through the same Na, and the presence of appreciable amounts of H_2 in the outgoing Ar indicated that NaH was present in the reaction products. Subsequent analysis of the contents of the reaction vessel at room temperature indicated that they were Na, NaOH, and NaH with less than 0.1% peroxide. There was no corrosion, by visual observation, of the 18/8/1 stainless steel nozzle or equipment. (auth)

62 AERE-C/R-2180

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CONTROL OF pH BY ION EXCHANGE. P. C. Davidge and D. E. Glanville. (Contains an addendum by E. Glueckauf.) Sept. 28, 1954. Decl. with amendment Oct. 16, 1956. 14p. Declassified version of LEO/RDC-8.

A method is presented for treating water to minimize the corrosion obtained in a stainless steel–water system. It consists of a mixed-bed ion exchanger with the cation resin in the Li state. This should remove all the soluble corrosion products and replace them with LiOH, thereby maintaining the pH. (W.L.H.)

63 IDO-28004

Aerojet General Corp., Azusa, Calif.

POLYPHENYL-COLLANT BURNOUT STUDIES. Monthly Progress Report No. 10 [for] August 16 through September 15, 1957. K. Sato. Oct. 16, 1957. 26p. Contract AT(04-3)-44, (AGC-L2917-10). $4.80(ph OTS); $2.70(mf OTS).

The objective of this program is to determine whether polyphenyl compounds, such as Santowax-R or other terphenyl compounds, are suitable as heat-transfer fluids in organic-moderated reactors. The maximum allowable heat flux to the fluid will be established experimentally by determining the heat-flux rate, at the beginning of film boiling, for various pressures, fluid velocities, and fluid temperatures. (auth)

64 IGRL-IB/R-27

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

RADIOACTIVE DECONTAMINATION PROCEDURES AND EQUIPMENT. Information Bibliography. Sept. 1957. 12p.

This is a selection of report, book, and journal references to publications issued up to December, 1956. Sources used were U.K., Canadian, and U.S. report abstracts, Nuclear Science Abstracts, Engineering Index (1950-1955), and Industrial Arts Index (1956). (auth)

65 AEC-tr-3051

DISTRIBUTION OF THE TEMPERATURE IN A REACTION VESSEL AND THE STATIONARY THEORY OF (THERMAL)

HEAT EXPLOSION. D. A. Frank-Kamenetskii (Frank-Kamenetsky). Translated from Zhur. Fiz. Khim. 13, 738-55(1939). 27p.

66 AEC-tr-3065

OXIDATION STAGES OF RUTHENIUM. II. OXIDATION POTENTIAL $Ru^{III} \rightleftharpoons Ru^{IV}$ IN HCl SOLUTION. G. Grube and G. Fromm. Translated by K. S. Bevis from Z. Elektrochem. 47, 208-211(1941). 9p.

In addition to the deposition of metals, the formation of mono- and bivalent Ru takes place in a cathode solution during electrolytic reduction of a HCl solution of $RuCl_3$. These two lower oxidation stages can be identified and quantitatively determined by potentiometric titration of the solution with H_2O_2. During the electrolytic reduction of strong HCl solutions, the bivalent form is preferably produced (along with the deposition of metals); in weakly acidic solution the monovalent stage predominates. (auth)

67

COMPOSITION VARIATION IN THE α-PHASE COMPOUND OF THE VANADIUM–ALUMINUM SYSTEM. A. E. Ray and J. F. Smith (Iowa State Coll., Ames). Acta Cryst. 10, 604-5(1957) Sept.

68

THE THERMAL DECOMPOSITION OF THE 2-METHYL-8-QUINOLINOL (8-HYDROXYQUINALDINE) CHELATES OF SCANDIUM, THORIUM, URANIUM(VI) AND THE RARE EARTH ELEMENTS. Wesley W. Wendlandt (Texas Technological Coll., Lubbock). Anal. Chim. Acta 17, 274-9 (1957) Sept.

The thermal decomposition of the 2-methyl-8-quinolinol (8-hydroxyquinaldine) chelates of Sc, Th, U^{6+}, Y and the rare earth elements was studied on the thermobalance. It was found that the Sc and U^{6+} chelates can lose the extra molecule of solvation by thermal decomposition. The thorium chelate was found to be the most stable of all the chelates studied. The temperature limits for the chelates and the minimum oxide level temperatures are given. (auth)

69

THERMOLYSIS OF THORIUM PRECIPITATES. II. SALTS OF ORGANIC ACIDS. Wesley W. Wendlandt (Texas Technological Coll., Lubbock). Anal. Chim. Acta 17, 295-9 (1957) Sept.

The thermal decomposition of the thorium salts of anisic, succinic, o-chlorobenzoic, adipic, dl-camphoric, m-iodobenzoic, α-naphthaleneacetic, o-toluic, vanillic and p-aminobenzoic acids were investigated on the thermobalance. The first weight losses occurred in the temperature range of 50° to 310°C. After various stages of decomposition, the oxide levels were obtained from 385° to 600°C. (auth)

70

THE ZIRCONIUM COMPOUNDS OF ETHYLENEDIAMINE-TETRAACETATE. A HETEROMETRIC STUDY. M. Bobtelsky and R. Rafailoff (Hebrew Univ., Jerusalem, Israel). Anal. Chim. Acta 17, 308-13(1957) Sept.

The compounds formed at pH's 1 to 7 between Zr and ethylenediaminetetraacetate (=E) were studied. The following soluble or insoluble compounds were obtained either as intermediates or as final compounds: $Zr_1E_1\uparrow$, $Zr_2E_2\downarrow$, $Zr_2F_1\downarrow$, $Zr_2E_1\downarrow$, $Zr_4E_1\downarrow$ and $Zr_6E_1\downarrow$. The composition and structure of the compounds and the reactions occurring were discussed. (auth)

71

DEPENDENCE OF HEATS AND FREE ENERGIES OF FORMATION OF ZIRCONIUM NITRIDES ON THE COMPOSITION AND STRUCTURE. E. I. Smagina, V. S. Kutsev, and B. F. Ormont (Karpov Physico-Chemical Inst.). Doklady Akad. Nauk S.S.S.R. 115, 354-7(1957) July 11. (In Russian)

In contrast to previously published data it has been established that zirconium nitride is a phase of variable content with a wide range of homogeniety. Preparations were obtained in the interval of $ZrN_{1.0}O_{0.04}$ to $ZrN_{0.56}O_{0.02}$ with heats and free energies of formation changing from 90.7 to 57.5 kcal/mole and from 81.1 to 52.3 kcal/mole, respectively. (R.V.J.)

72

A TRACER STUDY WITH O^{18} IN PHOTOSYNTHESIS BY ACTIVATION ANALYSIS. Ingrid Fogelström-Fineman, Osmund Holm-Hansen, Bert M. Tolbert, and Melvin Calvin (Univ. of California, Berkeley). Intern. J. Appl. Radiation Isotopes 2, 280-6(1957).

A method has been devised for tracer studies with oxygen using paper chromatography and proton activation of O^{18} to F^{18}. This technique is relatively simple and can detect a fraction of a μg of O^{18}, as well as giving some information about the chemical nature of the compound into which it is incorporated. The procedure has been applied to a preliminary study of the path of O_2 in green algae. Three short-term photosynthesis products containing O^{18} were observed. (auth)

73

STUDIES INVOLVING ISOTOPICALLY LABELLED FORMIC ACID AND ITS DERIVATIVES. II. RELATION OF THE ABSOLUTE REACTION RATES TO THE MAGNITUDES OF THE ISOTOPE EFFECTS IN THE OXIDATION OF FORMIC-C^{13} ACID BY HALOGEN ATOMS. Gus A. Ropp, C. J. Danby, and D. A. Dominey (Oak Ridge National Lab., Tenn. and Oxford Univ., Eng.). J. Am. Chem. Soc. 79, 4944-8(1957) Sept. 20.

For two reactions of formic-C^{13} acid in which the rate steps involve extraction of hydrogen by halogen atoms, the rate isotope effects, k_{12}/k_{13}, have been carefully evaluated by methods involving mass spectrometric analysis of carbon-13 dioxide. The difference between the measured values of k_{12}/k_{13} for the two reactions has been found to be in the direction that the slower reaction shows the greater degree of isotope fractionation. This principle which has also been noted in earlier studies is discussed in terms of the possible residual carbon-to-hydrogen bonding to be expected in the activated states for the two reactions. (auth)

74

THE DEUTERIUM ISOTOPE EFFECT ON THE RATE OF REACTION OF HYDROGEN AND IODINE. Ellington M. Magee (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 5375-9(1957) Oct. 20.

The ratio of rate constants has been determined for the reactions $H_2 + I_2$ and $HD + I_2$. An experimental method was used whereby errors in temperature, time, and concentrations were negligible. The ratios of H_2 : HD were determined in the reactants and in the first product formed. The value for k_{H_2}/k_{HD} was found to be 1.55. The significance of this result is discussed in relation to past experimental and theoretical work. (auth)

75

A FLUORIMETRIC STUDY OF THE THORIUM–MORIN SYSTEM. Robert G. Milkey and Mary H. Fletcher (U. S. Geological Survey, Washington). J. Am. Chem. Soc. 79, 5425-35(1957) Oct. 20.

Thorium reacts with morin to yield a yellow complex that fluoresces when irradiated with ultraviolet light. The effect on the fluorescence of such variables as concentration of acid, alcohol, thorium, morin, and complex; time, temperature and wave length of exciting light are studied to determine experimental conditions yielding maximum fluorescence. The effects of Zr^{+4}, Al^{+3}, Fe^{+3}, Ca^{+2}, and La^{+3} are discussed. The fundamental relationships be-

tween light absorption and fluorescence are expressed in a general equation that applies to a three-component system when the fluorescence is measured in a transmission-type fluorimeter. This general equation is used to obtain an expression for the fluorescence of the thorium–morin system. Equations, derived from experimental data, relate both the fraction of thorium reacted to form complex and the fraction of unquenched fluorescence to the concentration of uncombined morin. These functions, when combined with the general equation, give an expression which relates the total net fluorescence to the amount of uncombined morin in the solution. This last equation can be used to determine the one region for the concentration of uncombined morin that gives maximum sensitivity for the system. Calculated standard curves are in good agreement with experimental curves. (auth)

76

ISOTOPIC EXCHANGE REACTIONS. THE HALOGEN EXCHANGE BETWEEN $SiCl_4$ AND HCl. Rolfe H. Herber (Univ. of Illinois, Urbana). J. Chem. Phys. 27, 653-5(1957) Sept.

The kinetics of the isotopic chlorine exchange between $SiCl_4$ and HCl have been measured using the tracer Cl^{36}. The reaction is first order in HCl and second order in $SiCl_4$. E‡ and S‡ are 22.4 kcal $mole^{-1}$ and −17.6 cal deg^{-1} $mole^{-1}$, respectively. A mechanism for the exchange is proposed. (auth)

77

KINETICS OF COMPLEX ISOTOPIC EXCHANGE REACTIONS. D. F. Abell, N. A. Bonner, and W. Goishi (Univ. of California, Livermore). J. Chem. Phys. 27, 658-60(1957) Sept.

A general equation has been developed for the kinetics of complex isotopic-exchange reactions in which each of three nonequivalent species is exchanging with the other two. (auth)

78

FREQUENCY FACTORS AND ISOTOPE EFFECTS IN SOLID STATE STATE RATE PROCESSES. George H. Vineyard (Brookhaven National Lab., Upton, N. Y.). Phys. and Chem. of Solids 3, 121-7(1957).

The movement of defects in solids on the basis of classical absolute rate theory is reexamined with special attention to many-body aspects. The effective frequency in the Arrhenius expression governing these processes is shown to be, in harmonic approximation, the ratio of the product of the N normal frequencies of the entire crystal at the starting point of a transition to the product of the N-1 normal frequencies of the crystal when it is constrained in a saddle point configuration. The influence of the masses of the various atoms on the effective frequency is investigated. It is shown that an effective mass which depends on the direction of the path through the saddle point in configuration space determines this frequency. In the case of chemical diffusion by the vacancy mechanism the effective mass is approximately the same as the mass of the solute atom, and must always lie between the mass of the solute and the mass of the solvent. It is finally shown that the classical rate theory, even with many-body considerations, is unable to explain the recent observations of Lazarus and Okkerse on the isotope effect in the diffusion of iron in silver. (auth)

79

THE HEATS OF FORMATION OF METAL HALIDES. ZIRCONIUM TETRACHLORIDE. P. Gross, C. Hayman, and D. L. Levi (Fulmer Research Inst., Ltd., Stoke Poges, Buckinghamshire). Trans. Faraday Soc. 53, 1285-8(1957) Oct.

In order to determine the heat of formation of $ZrCl_4$, the heat evolved in the reaction $Zr\ (s) + 2\ Cl_2\ (l) \rightarrow ZrCl_4(s)$ has been measured. The derived heat of formation of $ZrCl_4$ from Zr and liquid Cl is −225.89 kcal/mole, leading to a value of −234.7 kcal/mole for the standard heat of formation. The heat of interaction between Cl and $ZrCl_4$ was shown to be negligible. (auth)

Aerosols

80

MOLECULAR SIEVES ADSORB IODINE-131 FROM AIR. Morris A. Wahlgren and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Nucleonics 15, No. 9, 156, 158, 160(1957) Sept.

Analytical Procedures

81 AERE-C/R-495

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MONITORING OF EFFLUENT FOR ALPHA EMITTERS. [PART] II. METHODS FOR THE DETERMINATION OF URANIUM, POLONIUM AND OTHER ALPHA EMITTERS. A. A. Smales, L. Airey, J. Woodward, and D. Mapper. June 1950. Decl. July 12, 1957. 39p.

Consideration has been given to the problem of separating and estimating U, Po, and other alpha emitters (in order to provide analytical methods for their routine determination in conformity with the draft agreement on the Harwell effluent). Uranium may be ether extracted from solutions of NH_4NO_3 as salting out agent at pH1 with an efficiency of 98 to 99%. The deposition of Po on Ag foil is a specific method for this element and under prescribed conditions similar extraction efficiencies may be obtained. An adequate separation from all "other alpha emitters" is obtained and methods for the estimation of these are discussed. A comprehensive scheme involving a preliminary activity concentration step has been elaborated. U, Po, and the majority of the "other alpha emitters" are precipitated as their tannin complexes at pH8 using $Ca(OH)_2$, the calcium-tannin complex acting as a carrier. That part of the activity remaining in solution is determined as in the total activity method, previously described. From the solution of the precipitate, Po is first separated by electrodeposition, and then U by ether extraction in the presence of NH_4NO_3. The majority of the "other alpha emitters" still in the aqueous NH_4NO_3 solution are collected on a second calcium-tannin precipitate, while the small part remaining in solution after this operation is obtained by direct evaporation. (auth)

82 AERE-C/R-1902

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A METHOD FOR THE DETERMINATION OF RADIOCALCIUM AND RADIOSTRONTIUM IN EFFLUENT. B. A. Loveridge. Mar. 1956. Decl. July 22, 1957. 27p.

Methods are presented for determining γ and β emitters (radiocalcium and radiostrontium) in radioactive effluent which may be discharged into the Thames River by Harwell. (W.L.H.)

83 AERE-C/R-2254

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION BY RADIOACTIVATION OF TRACE QUANTITIES OF ARSENIC, ANTIMONY AND COPPER IN PURE SILICON. A. A. Smales, D. Mapper, A. J. Wood, and L. Salmon. Apr. 1957. 30p.

A method is described for the determination of As, Sb, and Cu in pure Si semi-conductor material. The method

involves irradiation of the Si in the Harwell Pile, followed by radiochemical separation of the individual elements using carriers and, finally, comparison of the radioactivity due to these elements from the samples with that from known amounts of the elements that were irradiated simultaneously. About 300 to 400 mg of Si are taken for the determination, and the method of dissolution, fusion of the Si in a Ni crucible with 5 gm of NaOH and 1 gm of KNO_3, does not involve any losses of the volatile elements, As and Sb. This was proved by direct determination of these elements on the chemically untreated Si, using the γ spectrometer. Arsenic, Sb, Cu, Ta, and Zn are also determined directly on the γ spectrometer in favorable circumstances, but radiochemical separations are often necessary, e.g. when the As present is at the 0.001 to 0.1 ppm level. A particular sample of Si, containing 4.5 ppm As, 0.8 ppm Sb, and 3.1 ppm Cu, which gave high values for the As determined directly on the spectrometer, is used to illustrate the need for caution in the use of the spectrometer when resolving photopeaks produced by nearly equal γ energies. The results obtained on 10 samples of Si for As varied from 0.002 to 22.6 ppm, for Sb from 0.001 to 0.88 ppm, and for Cu from 0.001 to 3.1 ppm, the inhomogeneity of a number of the samples being one of the difficulties encountered. (auth)

84 CF-57-8-1

Oak Ridge National Lab., Tenn.

A CURRENT REVIEW OF BODY FLUID ANALYSIS, PROCEDURES, AND METHOD OF REPORTING—JANUARY 1957. P. E. Brown, D. M. Davis, and L. C. Henley. Aug. 1, 1957. 38p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

85 CRDC-711

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DETERMINATION OF FISSILE MATERIAL BY NEUTRON ACTIVATION ANALYSIS. W. D. Mackintosh and R. E. Jervis. Aug. 1957. 16p. (AECL-483).

Direct α counting to determine fissile material in dilute solutions of high total solids content is likely to be inaccurate due to the difficulty of preparing thin sources. This report describes a neutron-activation analysis method which eliminates this risk. Results obtained by the neutron-activation analysis for U^{233} in solution are compared with results obtained from other methods. The standard deviation and sensitivity are shown. (auth)

86 GAT-213

Goodyear Atomic Corp., Portsmouth, Ohio.

FREEZING POINT DETERMINATIONS OF THE URANIUM HEXAFLUORIDE–HYDROGEN FLUORIDE SYSTEM. H. L. Bullard, A. S. Ostroski, and W. S. Stringham. Oct. 8, 1957. 14p. Contract AT(33-2)-1. $0.50(OTS).

A more efficient and time-conserving method for the production analysis of small amounts of HF in UF_6 is presented. The apparatus includes automatic controlling-recording equipment and thermistors. The amount of HF as an impurity is determined by measuring the depression in the UF_6 freezing point. The use of calibration curves is necessary to correct for the variation of gaseous volume above the liquid level. (auth)

87 HW-51452

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN APPARATUS FOR THE DETERMINATION OF TOTAL GAS IN FUEL ELEMENT SAMPLES. R. I. Miller. July 30, 1957. 13p. Contract W-31-109-Eng-52. $0.50(OTS).

A description is given of an apparatus which is capable of analyzing six uranium samples per 8 hours for total gas content. Drawings and discussion of various parts of the system are given. Possibilities of increasing the speed of analysis are discussed. (auth)

88 KAPL-1786

Knolls Atomic Power Lab., Schenectady, N. Y.

ESTIMATION OF B-10 BURNUP BY FLAME PHOTOMETRIC LITHIUM DETERMINATION. D. Dutina. May 14, 1957. 18p. Contract W-31-109-Eng-52. $0.50(OTS).

In connection with the S3G burnable poison and control rod program, it became necessary to estimate the burnup of neutron-irradiated steel, Zr, and Zircaloy alloyed with B^{10}. A method is described in which the burnup is measured by determining with a flame photometer the Li^7 produced by means of the $B^{10}(n,\alpha)Li^7$ reaction. An NH_3 precipitation of the hydrolyzable radioactive materials is carried out remotely and reduces the radioactivity sufficiently to permit the Li analysis of the filtrate with ordinary laboratory handling methods. (auth)

89 KAPL-A-HP-3

Knolls Atomic Power Lab., Schenectady, N. Y.

HEALTH PHYSICS MANUAL OF RADIOCHEMICAL AND CHEMICAL ANALYSES AND PROCEDURES. M. R. Kennedy. May 15, 1957. 70p. Contract W-31-109-Eng-52. $2.00(OTS).

The radiochemical and chemical analyses of the routine health physics monitoring program are described in this manual. (auth)

90 WADC-TR-57-406

Delaware. Univ., Newark.

THE OXIDATIVE DEGRADATION OF LARGE MOLECULES. Harold C. Beachell. July 1957. 42p. Project title: POLYMER OXIDATION RESEARCH. Contract AF-33(616)-465. (AD-130854).

Oxidative degradation studies were made on several polymeric materials. Polyethylene, both low and high density, shows a slower rate of reaction for the Ziegler type (high density). The rate data can be interpreted by the Elovich equation for heterogeneous reaction at a gas solid interface. In a similar manner polystyrene and deuteropolystyrenes were studied both by carbonyl development and oxygen adsorption. The results indicate a free radical mechanism via peroxide formation. Owing to the free radical nature of the process, the introduction of radicals by the irradiation of polymers with gamma radiation from Co^{60} was undertaken. (auth)

91 RMO-3001

Pitkin (Lucius), Inc. Western Uranium Project, Grand Junction, Colo.

GRAND JUNCTION OPERATIONS OFFICE ANALYTICAL LABORATORY HANDBOOK OF ANALYTICAL METHODS. R. W. Langridge, comp. and ed. Feb. 1, 1957. 53p. Contract AT(05-1)-636. $0.40(OTS).

92 TID-7002(Rev. I)

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

RAW MATERIALS DEVELOPMENT LABORATORY HANDBOOK OF ANALYTICAL METHODS. Michael A. DeSesa, comp. and ed. July 30, 1957. 136p. Contract [AT(49-6)-924]. $3.75(OTS).

Analytical methods are presented for the following chemical determinations: free acid in presence of hydrolyzable ions, acid consumption during ore leaching, alcohol modifiers in organic extractants, carbonates and bicarbonates with or without U in solution, amines in kerosene solvents, As, B, Ca, CO_3 in carbonate, Cl^-, Co, Cu, di-(2-ethylhexyl) phosphoric acid in kerosene, F^-, Fe, Mg, Mn, Mo, NO_3^-, PO_4^{3-}, SiO_2, S, SO_4^{2-}, tetrathionates, Th, TBP, U, and V. These procedures are set up for

application to some phase of uranium ore processing operations. (T.R.H.)

93 UR-501

Rochester, N. Y. Univ. Atomic Energy Project. POLONIUM URINALYSIS. Carolyn A. Krebs and G. Hoyt Whipple. July 5, 1957. 14p. Contract W-7401-eng-49. $0.50(OTS).

A method is described for routine urinalysis for Po by plating on copper at room temperature from acid solution. A discussion is presented based on experience gained by this laboratory in working with the method over a four-year period. (auth)

94 WASH-736

Los Alamos Scientific Lab., N. Mex. PROCEEDINGS OF THE SECOND ANNUAL MEETING ON BIO-ASSAY AND ANALYTICAL CHEMISTRY, OCTOBER 11 AND 12, 1956. Sept. 27, 1957. 163p. $4.25(OTS).

Topics discussed include procedures for the determination of Po in urine, feces, and blood; the determination of Be in biological materials; application of statistical methods to bio-assay; techniques for low-level α counting and pulse-height analysis; the toxicology of plutonium; the metabolism and toxic effects of fission products; methods for the radiometric determination of I^{131} and Sr^{90} in urine; procedures for the radiochemical analysis of Sr and Ba in human urine; and the design and performance of a whole-body γ counter. (See also NLCO-595.) (C.H.)

95 USNRDL-TR-168

Naval Radiological Defense Lab., San Francisco. A METHOD FOR MEASURING WATER CONTENT OF AIR-BORNE SEA-SALT PARTICLES. N. H. Farlow. May 13, 1957. 16p. Project NS-081-001.

A calibrated technique is presented which measures the volume of water contained in naturally occurring slurry-like sea-salt particles in the atmosphere. The measurement has on the average a standard deviation error from the mean of ±25 percent. The method employs a quantitative chloride reagent film on which the solids in the slurry particle leave a visible trace. The area covered by this artifact is a function of the particle water content. A curve is shown presenting the relationship of slurry artifact diameter to water content. (auth)

96 AEC-tr-3052

DETERMINATION OF THE DISSOLVED OXYGEN IN WATER WITH LEUCOINDIGOCARMINE AND COMMENTS ON THE O_2 DETERMINATION. K. Wickert and E. Jaap. Translated by K. S. Bevis from Z. anal. Chem. 145, 338-44(1955). 6p.

A method is described for the colorimetric determination of dissolved oxygen in water. Indigocarmine is used as an indicator. (C.H.)

97 AEC-tr-3058

THE USE OF COMPLEXONES IN CHEMICAL ANALYSIS. XXVIII. SELECTIVE DETERMINATION OF CALCIUM. R. Pribil and L. Fiala. Translated from Chem. Listy 46, 331-7(1952). 14p.

A new modification of the method of precipitating Ca with potassium oxalate from a medium of acetic acid and ammonium acetate is described, based upon the binding of the other elements into firm complexes with the disodium salt of ethylenediaminetetraacetic acid (complexone III). The proposed method permits the direct determination of the Ca without any separation from Hg, Pb, Bi, Cu, Cd, As, Sb, Fe, Cr, Al, Ti, Be, U, Mo, W, Ce, Th, Ni, Co, Mn, Zn, Mg, and phosphoric acid. The advantage of the method was shown during practical analysis of calcium–lead and certain minerals. (auth)

98

THE MICRO VOLUMETRIC DETERMINATION OF URANIUM WITH APPLICATION TO BISMUTH BASE ALLOY ANALYSIS. G. W. C. Milner and G. A. Barnett (Atomic Energy Research Establishment, Harwell, Eng.). Anal. Chim. Acta 17, 220-5(1957) Aug.

The macro volumetric method for the determination of U by titration against standard $CeSO_4$ after reduction on a Pb column has been successfully applied on the micro scale. Microgram amounts of U can be determined by this method, the lowest amount determinable being about 1 microgram. The procedure is accurate to within ±1% at the 100 μg level of U. Although Bi and Fe cause difficulty, there is no interference from Zr or Th. This method for U has been applied to the analysis of Bi base alloys containing U in concentrations from 0.005 to 0.1% by weight. (auth)

99

ION EXCHANGE SEPARATIONS IN THE ANALYSIS OF BISMUTH BASE ALLOYS. PART I. BINARY ALLOYS WITH URANIUM AND THORIUM. G. W. C. Milner and J. W. Edwards (Atomic Energy Research Establishment, Harwell, Eng.). Anal. Chim. Acta 17, 259-63(1957) Aug.

Procedures are described for the determination of U (0.001 to 10%) and Th (0.05 to 10%) in binary mixtures with Bi. A preliminary separation of the Bi is effected by the passage of a HCl solution of the sample through a column of Deacidite FF. For Th contents greater than 1%, the determination is completed volumetrically with EDTA using pyrocatechol violet as indicator; smaller amounts are determined absorptiometrically with thoronol. Similarly the higher U contents are determined volumetrically after reduction to the tetravalent state with a Pb reductor, and an absorptiometric method based on the colored complex formed by U^{4+} with thoronol is used for the smaller amounts. (auth)

100

THE PHOTOMETRIC TITRATION OF NICKEL IN THE PRESENCE OF COBALT. L. D. Brake, W. M. McNabb, and J. F. Hazel (Univ. of Pennsylvania, Philadelphia). Anal. Chim. Acta 17, 314-17(1957) Sept.

A spectrophotometric titration of Ni in the presence of Co is described using disodium ethylenediamine tetraacetic acid as a titrant. The end-point was obtained by plotting the corrected absorbancy against ml of titrant added. Nickel concentrations of 2.5 to 25 mg were determined in the presence of up to 8 mg of Co with an error of 1½% or less depending upon the concentration of versenate used. A 0.03M and 0.1M versenate was used. The effects of pH, concentrations of Ni and Co, accuracy of the method, presence of interfering elements, and limitation of the method are discussed. (auth)

101

VOLTAMMETRIC BEHAVIOR OF THE IRON(II)-(III) AND CERIUM(III)-(IV) COUPLES IN POTENTIOMETRIC TITRATIONS AT CONSTANT CURRENT AND AMPEROMETRIC TITRATIONS WITH TWO INDICATOR ELECTRODES. I. M. Kolthoff and E. R. Nightingale, Jr. (Univ. of Minnesota, Minneapolis). Anal. Chim. Acta 17, 329-38 (1957) Sept.

The voltammetric behavior at the rotated platinum electrode of the $Fe^{2+}-Fe^{3+}$ and $Ce^{3+}-Ce^{4+}$ couples in H_2SO_4 and HCl has been investigated. The Fe and Ce are not reversible at a platinum electrode when current flows in the system, and the current-potential curves deviate considerably from those predicted on the basis of reversibility. Titration curves for potentiometric titrations at constant current using one and two indicator electrodes are predicted from the current-potential curves and compared

with the experimental curves. The degree of reversibility of the iron couple depends greatly on the pretreatment of the electrode. The current-potential curves of the iron couple at a platinum electrode coated with a monomolecular film of platinum oxide approach reversibility while those at a clean electrode are highly irreversible. Experimental and calculated titration lines for amperometric titrations using two indicator electrodes are compared, and the effects of medium and applied emf upon the characteristics of the titration curves are considered. (auth)

102

POLAROGRAPHY OF URANIUM. III. URANIUM(VI) IN FLUORIDE MEDIA. David J. McEwen and Thomas De Vries (Purdue Univ., Lafayette, Ind.). Can. J. Chem. 35, 1225-36(1957) Oct.

The uranium(VI) and (V) polarographic waves were studied in chloride and perchlorate supporting electrolytes of 0.1 M to almost neutral acidities and containing 0 to 100 fold excess of fluoride. The concentrations of the uranium(VI)–fluoride species ($UO_2F_n^{+2-n}$, n = 1 – 4) were calculated and it is shown that the first two species, UO_2F^+ and UO_2F_2, are either reduced reversibly at the D.M.E., or dissociate rapidly to the uncomplexed ion, UO_2^{++}, which is known to reduce reversibly. The $UO_2F_4^=$ species, and possibly also $UO_2F_3^-$, is reduced irreversibly, and the rate constant of the electron transfer process, k_f^*, and the transfer coefficient, α, were calculated by two methods. The electrode reaction is proposed as $UO_2F_n^{+2-n} + e^- = UO_2^+ + nF^-$. The rate of disproportionation of uranium(V) was found to depend upon the F/U ratio, and the rate constants for the reaction were calculated. (auth)

103

METHODS FOR QUANTITATIVE MEASUREMENT OF IRIDIUM CONTENT IN PLATINUM. G. Airoldi and E. Germagnoli (CISE Labs., Milano). Energia nucleare (Milan) 4, 301-6(1957) Aug.

The concentration of Ir in a sample of very pure Pt is measured with two independent methods of activation analysis. Quite consistent results are found. The accuracies of the described methods are limited only by uncertainty in the value of the activation cross section of Ir. (auth)

104

URANIUM AND BARIUM IN STONE METEORITES. Hiroshi Hamaguchi, George W. Reed, and Anthony Turkevich (Univ. of Chicago, Ill. and Argonne National Lab., Lemont, Ill.). Geochim. et Cosmochim. Acta 12, 337-47 (1957).

The U and Ba contents of some meteorites (4 chondrites and 1 achondrite), a basalt and a dunite have been determined by neutron activation. The isotopic composition of the U in the stone meteorites has been shown to be the same as that of terrestrial U to within 10 %. The U content of the chondrites is close to 1.1×10^{-8} g/g; that of the achondrite (Nuevo Laredo) is about ten times higher. The Ba contents are all about 350 times the U contents. The results are compared with previous determinations. (auth)

105

SPECTROPHOTOMETRIC DETERMINATION OF TITANIUM WITH PHENYLFLUORONE. V. Damodaran (National Chemical Lab., Poona). J. Sci. Ind. Research (India) 16B, 366-9(1957) Aug.

A sensitive method has been developed for the spectrophotometric estimation of microgram quantities of titanium. The method is based on the formation of a pink complex between phenylfluorone and tetravalent titanium in the acid range. (auth)

106

MICRODETERMINATION OF CARBON IN IRON IRRADIATED BY PROTONS. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/48. J. J. Point. London, Pergamon Press, Ltd., 1957. 8p. (In French)

107

INVESTIGATIONS ON THE U_3O_8-ZrO_2-O_2 AND U_3O_8-TiO_2-O_2 SYSTEMS BY THE EMANATION METHOD. Presented at the International Conference on Radioisotopes in Scientific Research Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/198. G. Wolf, L. Ochs, and F. Strassman. London, Pergamon Press, Ltd., 1957. 10p.

RdTh is incorporated into U_3O_8, ZrO_2, and TiO_2 after which the individual components or the mixtures of U_3O_8–ZrO_2, and U_3O_8–TiO_2 are slowly heated to 1400°C in an oxygen stream. The escaping thoron is fed through an ionization chamber where the activity is continuously measured in a vibrating reed electrometer and registered on an automatic recorder. The heated mixtures are examined by x-ray methods in order to verify a reaction between the components. In both systems the emanation curves of the components were altered. In the U_3O_8–TiO_2 system both chemical and x-ray methods showed the formation of a compound $TiO_2 \cdot UO_3$. However in the system U_3O_8–ZrO_2 no change in the x-ray pattern could be noticed. Therefore the study of emanation curves seems to be a sensitive method for verification of reactions in the solid state. (auth)

108

MODEL '54 TRANSMISSION AND REFLECTION FLUORIMETER FOR THE DETERMINATION OF URANIUM WITH ADAPTATION TO FIELD USE. Ernest E. Parshall and Lewis F. Rader, Jr. U. S. Geol. Survey Bull. 1036-M. 1957. 34p. and 1 illus. $0.60.

The model '54 fluorimeter for the determination of uranium by the fluorimetric method has been designed, built, and used in the U. S. Geological Survey since 1950, and is one of several such instruments developed by the Geological Survey. An adaptation for field use is included in the present description of the instrument. The circuit is a modification of that used in the Beckman DU spectrophotometer and incorporates an electrometer, amplifier, and blue-sensitive phototube as used in the DU instrument because of the extraordinary sensitivity obtained for a phototube of this type. The low-voltage circuit used in the Model '54 fluorimeter results in an unusually broad working range of high sensitivity and stability for the instrument. Changes in temperature have little or no effect on the accuracy of readings made under conditions expected in field work. A detailed description of the instrument and of its use in fields and laboratory is accompanied by photographs, working drawings, and instructions that would make possible its construction in the average machine shop. (auth)

Crystallography and Crystal Structure

109

THE STRUCTURE OF OXIDE FILMS FORMED ON SMOOTH FACES OF A SINGLE CRYSTAL OF COPPER. W. W. Harris, F. L. Ball, and A. T. Gwathmey (Univ. of Virginia, Charlottesville). Acta Met. 5, 574-81(1957) Oct.

Oxide films, which were formed on the (311), (111) and (100) faces of a single crystal of Cu heated at 150°C, were removed electrolytically from the Cu and examined with an electron microscope. The structure of the oxide was found to be related to crystal face of the Cu, and three types of structure were observed. On each face the film consisted of: (1) small nuclei from less than 20 to 80 A in diameter, (2) regularly shaped masses of oxide from

80 to 3000 A in diameter, and (3) a crystalline base film initially unresolvable with the electron microscope. (auth)

110

CRYSTAL DATA ON THORIUM-CIS-DIBENZOYLMETHANE AND THE ISOMORPHOUS COMPLEXES OF TETRAVALENT CERIUM AND URANIUM COMPOUNDS. Leopold Wolf and Hartmut Bärnighausen. Acta Cryst. 10, 605-6(1957) Sept. (In German)

Deuterium and Deuterium Compounds

111

MEASUREMENT OF DEUTERIUM CONTENT IN HIGHLY ENRICHED SAMPLES OF HEAVY WATER BY MEANS OF A FLOAT METHOD. N. Adorni, B. Brigoli, and M. Silvestri (CISE Labs., Milano). Energia nucleare (Milan) 4, 315-18(1957) Aug.

A method for the absolute deuterium concentration measurement in highly enriched heavy water by means of a float device, is described. Reference water, of concentration extremely near 100% of D_2O, is prepared each time from unknown water itself by electrolysis. Accuracy is better than 0.01% D_2O. (auth)

Fluorine and Fluorine Compounds

112 NACA-RM-E56K21

Lewis Flight Propulsion Lab., Cleveland.

MATERIAL COMPATIBILITY WITH GASEOUS FLUORINE. Harold G. Price, Jr., and Howard W. Douglass. Nov. 19, 1956. 5p.

Static tests on the compatibility of fluorine with nonmetals at atmospheric temperature eliminated many materials from further consideration for use in fluorine systems. Several materials were found compatible at atmospheric pressure. Only Teflon and ruby (aluminum oxide) were compatible at 1500 psig. (auth)

113 ORNL-2363

Oak Ridge National Lab., Tenn.

F^{18} EXCHANGE BETWEEN FLUOROCARBONS AND SOME FLUORINE-CONTAINING COMPOUNDS. T. A. Gens. Oct. 17, 1957. 124p. Contract W-7405-Eng-26. $3.00(OTS).

Isotopic exchange between solid inorganic fluorides and gaseous fluorocarbons was observed for the first time. Rates of many of these exchange reactions were studied at temperatures as low as 0°. Of the inorganic fluorides studied, the exchange was most rapid with alkali metal fluorides. Among the alkali fluorides the rate of the exchange reaction increased markedly with increasing atomic number of the cation. (W.L.H.)

114

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. XIII. BENZOTRIFLUORIDE. N. A. Narasimham, J. Rud Nielsen, and Rose Theimer (Univ. of Oklahoma, Norman). J. Chem. Phys. 27, 740-5(1957) Sept.

The infrared absorption spectrum of gaseous benzotrifluoride has been obtained with a 1-m cell and a Perkin-Elmer double-pass spectrometer equipped with NaCl and CsBr prisms. The Raman spectrum of liquid $C_6H_5CF_3$ has been photographed with a 3-prism glass spectrograph of reciprocal linear dispersion 15 A/mm at 4358 A, and depolarization ratios have been measured for most of the Raman bands. Under the assumptions that the molecule has approximately the symmetry C_{2v} and that phenyl and CF_3 vibrations are weakly coupled, all but 3 of the vibrational fundamentals have been assigned and classified as follows: Species a_1 336, 770, 1004, 1028, 1072, 1180, 1457, 1614, 2995, 3022, and 3096 cm^{-1}; Species b_1: 199, 618, 902, 1127, 1237, 1362, 1457, 1614, 3022, and 3096 cm^{-1}; Species b_2: 139, 485, 695, 770, (800), and 923 cm^{-1}; Species a_2: 235, 844, and (ca 950) cm^{-1}; CF_3 vibrations: (ca 150), 321, 398, 596, (2 funds.), 657, 1152 (2 funds.), and 1328 cm^{-1}. The spectra have been interpreted in detail. (auth)

115

STRUCTURE OF THE INTERHALOGEN COMPOUNDS. III. CONCLUDING NOTE ON BROMIDE TRIFLUORIDE, BROMINE PENTAFLUORIDE, AND IODINE PENTAFLUORIDE. Robinson D. Burbank and Frank N. Bensey, Jr. (Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Chem. Phys. 27, 982-3(1957) Oct.

116

THE PREPARATION AND PROPERTIES OF VANADIUM PENTAFLUORIDE. L. E. Trevorrow, J. Fischer, and R. K. Steunenberg (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 5167-8(1957) Oct. 5.

Vanadium pentafluoride was prepared by the reaction of F and V metal at 300°C. Measurements of the vapor pressure of the liquid from 24.1 to 85.5°C resulted in a normal boiling point of 47.9°C. The melting point was 19.0 ± 0.9°C. Vapor density measurements indicated that the molecular species present in the vapor phase is VF_5. (auth)

Graphite

117 NP-6444

Buffalo. Univ.

PROGRESS REPORT NO. 1 [FOR] JUNE 1, 1957 TO AUGUST 31, 1957. Dept. of Physics. Sept. 1, 1957. 8p. Contract AF-33(616)-5186.

118

VARIATIONS IN ISOTOPIC COMPOSITION OF CARBON FROM METAMORPHIC ROCKS IN NORTHERN SWEDEN AND THEIR GEOLOGICAL SIGNIFICANCE. Sven Gavelin (Univ. of Stockholm, Sweden). Geochim. et Cosmochim. Acta 12, 297-314(1957).

The C^{12}/C^{13} ratio has been determined in 108 samples of graphites from metamorphic Pre-Cambrian and Caledonian sediments in northern Sweden. The aim of the investigation has been to ascertain if variations in the isotopic composition of carbon can contribute to a solution of petrogenetic problems when conventional petrographic methods fail. No correlation could be established between C^{12}/C^{13} ratio on the one hand and degree of kineto-metamorphism, thermal or "regional" metamorphism on the other. It seems possible that at least some C^{12}/C^{13} variations reflect fluctuations in the original sedimentary milieu, but nothing definite can be stated concerning the mechanism of isotopic fractionation in sedimentary processes. (auth)

119

CONTACT EFFECTS RESULTING FROM COMPRESSION AND FLASH SINTERING IN GRAPHITE POWDERS. F. A. Lewis, J. Orr, and A. R. Ubbelohde (Imperial Coll.). Proc. Phys. Soc. (London) B70, 928-36(1957) Oct.

Experiments are described on contact resistance effects in graphite powders: (i) as these are progressively compressed up to 3600 kg cm^{-2} in the cold: this produces a marked decrease of electrical resistance, though it seems unlikely that much compression of the actual crystal lattice of graphite is effected; (ii) when loosely pressed powder is subjected to flash discharges from a bank of charged condensers ('flash sintering'): this is in order to explore possible mechanisms of sintering that avoid any prolonged heating of the graphite at high temperatures. In the case of powdered polycrystalline graphite, both (i) and (ii) lead to a marked lowering and stabilization of the electrical resistance. Their influence on the thermoelectric power

is discussed. 'Flash sintering' promises to be a useful and accessible technique in studying the conductance of crystal compounds of graphite. The results throw a significant light on the nature of the conductance barriers in graphite powders. (auth)

Laboratories and Equipment

120

THE HOT CELL. C. Cesarano. Energia nucleare (Milan) 4, 267-82(1957) Aug. (In Italian)

The necessity of handling and measuring highly active materials, allowing the operator a sufficient protection against radiation, has brought to perfection the constructive technique of hot laboratories. Very delicate handlings can be carried out at present in the hot cells, with high safety for the person operating from outside. The problems connected with the choice of materials, the installation and management of hot cells are reviewed. (auth)

121

REMOTE HANDLING. 3. ALPHA-ACTIVE MATERIALS. W. K. Curtis (A.E.R.E., Harwell). Nuclear Eng. 2, 381-5 (1957) Sept.

122

A NEW MICROBALANCE OF QUARTZ FOR WORK IN HIGH VACUUM. Herbert Mayer and Klaus Behrndt. Z. Physik 147, 499-506(1957). (In German)

Radiation Chemistry

123 AEC-tr-3059

THE INFLUENCE OF GAMMA RAYS ON THE OXIDATION OF CETANE. M. A. Proskurnin, Yu. L. Khmel'nitskii, E. V. Barelko, A. T. Slepneva, and I. I. Melekhonova. Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 112, 886-9(1957). 7p.

124

THE EFFECT OF BROMINE SCAVENGER ON THE YIELDS OF INDIVIDUAL ORGANIC PRODUCTS OF THE $Br^{81}(n,\gamma)Br^{82}$ PROCESS IN PROPYL BROMIDES. J. C. W. Chien and J. E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 79, 4872-6(1957) Sept. 20.

The yields of eleven organic products of the $Br^{81}(n,\gamma)Br^{82}$ process in n-propyl bromide and in isopropyl bromide have been determined with and without 5×10^{-2} mole fraction of Br_2 present for the purpose of distinguishing the re-entry into organic combination which occurs by "hot" processes from that which results from "thermal" processes. The dibromopropanes and hexyl bromide are formed almost exclusively by hot processes. The parent propyl bromide is formed about equally by the two types and the other products involve the two in varying proportions. The ratios of products show correlation with the structure of the parent propyl bromide. The effect of increasing bromine concentration in decreasing the organic yields in the propyl bromides is the same for activation by each of the three processes, $Br^{79}(n,\gamma)Br^{80m}$, $Br^{79}(n,\gamma)Br^{80}$ and $Br^{80m} \xrightarrow{I.T.} Br^{80}$, indicating that in each case the same fraction of the new born energetic atoms enter stable organic combination before diffusing as thermal atoms. (auth)

125

IRRADIATION OF PETROLEUM HYDROCARBONS. I. ELECTRON BOMBARDMENT OF LIQUID BUTANES. V. J. Keenan, R. M. Lincoln, R. L. Rogers, and H. Burwasser (Atlantic Refining Co., Philadelphia, Penna.). J. Am. Chem. Soc. 79, 5125-8(1957) Oct. 5.

The irradiation of liquid n-butane by 1 million volt electrons yields principally mixtures of octenes and octanes. Smaller amounts of hydrogen, ethane, butene, and higher products, i.e., C_{12}, C_{16}, and C_{20} hydrocarbons, are also encountered. Isobutane yields, in addition to such products, methane, propylene, and large amounts of C_7 hydrocarbons which are attributed to the formation of C_3 fragments and their subsequent participation in addition or combination reactions. The carbon skeletons and relative amounts of the C_8 isomers have been determined but do not unequivocally indicate the manner of formation of these compounds. (auth)

126

CHEMICAL EFFECTS OF HOT ATOMS. Louis Monchick, Koichi Funabashi, and John L. Magee (Univ. of Notre Dame, Ind.). J. Chem. Phys. 27, 734-9(1957) Sept.

A model is presented for the study of the chemical effects which result from the passage of energetic atoms through liquid or gaseous media. The particular case of energetic Br atoms in CH_3Br is treated in detail. The average rate of energy loss, the range, and the number of C−Br bonds broken in primary events have been calculated. The track structure and the nature of chemical effects are discussed. (auth)

127

NUCLEAR CHEMISTRY. Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Nucleonics 15, No. 9, 125-7(1957) Sept.

The history of the development of nuclear chemistry is reviewed briefly. The coming decade will provide a detailed theoretical explanation of fission, interesting results on atmosphere circulation, water turnover and hydrogeology may be expected through the use of tritium tracers, the spread of nuclear reactors and improved discrimination among induced radioactivities will spur analysis by neutron activation, spent fuel or by-product radiation from reactors will soon be the cheapest source of radiation, tracer methods may be applied in determining the properties of elements 104 and beyond, and increasing attention will be given to methods and techniques of nuclear chemistry of industrial interest. (C.H.)

128

RADIATION POLYMERIZATION. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/22. S. S. Medvedev. London, Pergamon Press, Ltd., 1957. 11p.

Radiation Effects

129 AERE-M/R-1863A

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME FURTHER EXPERIMENTS ON RADIATION DAMAGE IN MAGNESIUM OXIDE. F. P. Clarke. May 1957. 21p.

Further experiments on ultraviolet and neutron irradiation of single crystals of MgO are reported. The role of the many impurities present is discussed, and the band scheme is extended to cover the observations. (auth)

130 NAA-SR-1999

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EXPERIMENTAL DETERMINATION OF THE RADIATION DECOMPOSITION OF BORON-10 ENRICHED BORON TRIFLUORIDE AND THE RESULTANT CORROSION OF THE CONTAINING MATERIALS. W. K. McCarty. Oct. 15, 1957. 32p. Contract AT-11-1-GEN-8. $1.00(OTS).

A series of experiments is described in which Al cap-

sules containing metal specimens were filled with B^{10} enriched BF_3 and irradiated in the MTR. Post-irradiation measurements determined the extent of radiolysis of the BF_3 and the extent of corrosion of the metal specimens. Neither of these phenomena was found to be a serious problem in the design of safety devices incorporating BF_3. (auth)

131 WADC-TR-56-534(Pt. I)
Stanford Research Inst., Menlo Park, Calif.
NUCLEAR RADIATION EFFECTS ON STRUCTURAL PLASTICS AND ADHESIVES. PART I. LITERATURE SURVEY. Period Covered: April 15, 1956 to September 30, 1956. Edwin M. Kinderman and Shirley B. Radding. Feb. 15, 1957. 75p. Project title: ANPP SUPPORT. Task title: RADIATION EFFECTS. Contract AF33(616)-3632. (AD-130837).

The literature of radiation chemistry was surveyed. Information pertinent to the effect of radiation on the synthesis and the properties of polymers, elastomers, and adhesives was tabulated. A brief summary of the more general observations on the effects of radiation on these materials was prepared. (auth)

132
EFFECT OF IONIZING RADIATIONS ON FATTY ACID ESTERS. J. R. Chipault, O. S. Privett, G. R. Mizuno, E. Christense Nickell, and W. O. Lundberg (Univ. of Minnesota, Austin). Ind. Eng. Chem. 49, 1713-20(1957) Oct.

The effects of β and γ radiations on fatty acid esters were studied under various conditions. (W.L.H.)

133
THE PROTECTIVE ACTION OF CRUDE PETROLEUM FOR METAL–PORPHYRIN COMPLEXES EXPOSED TO GAMMA IRRADIATION. H. N. Dunning (Bureau of Mines, Bartlesville, Okla.). J. Am. Chem. Soc. 79, 5320-1(1957) Oct. 5.

134
EFFECT OF GAMMA RADIATION ON RUBBER SOLUTIONS. G. I. Finch, Sharda Das Gupta, and A. K. Das Gupta (National Chemical Lab., Poona). J. Sci. Ind. Research (India) 16B, 328-30(1957) Aug.

Solutions of crêpe rubber in carbon tetrachloride, tetrahydrofuran, benzene, and ethylene dichloride were exposed to the radiations from a 100-Mc Ra-Be source. Changes in color, viscosity, and infrared absorption spectra, which occurred only in the carbon tetrachloride solutions, have been followed. Cyclization has been observed in the final irradiated product which resembled that obtained by heat treatment of rubber with sulfuric acid. (auth)

135
RETICULATION OF VINYL CHLORIDE UNDER THE EFFECTS OF IONIZING RADIATION. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/23. C. Wippler. London, Pergamon Press, Ltd., 1957. 9p. (In French)

136
EFFECTS OF IONIZING RADIATIONS ON SOLIDS. I. PHYSICAL BACKGROUND. M. Daniels and J. Weiss (Univ. of Durham, Eng.). Research (London) 10, 341-4(1957) Sept.

The chemical effects of ionizing radiations are discussed beginning with information about the physical processes involved in radiation absorption. (T.R.H.)

137
EFFECTS OF IONIZING RADIATIONS ON SOLIDS. II. SOME CHEMICAL EFFECTS. M. Daniels and J. Weiss (Univ. of Durham). Research (London) 10, 396-401(1957) Oct.

The effects of ionizing radiations on the chemical properties of solids and the chemical effects of ionizing radiations on ionic crystals and inorganic and organic molecular compounds are presented. (W.L.H.)

138
PRODUCTION OF COLLOIDAL SODIUM IN NaCl BY IONIZING RADIATION. W. Dale Compton (U. S. Naval Research Lab., Washington). Phys. Rev. 107, 1271-5(1957) Sept. 1.

A study has been made of the coloration of synthetic and natural NaCl crystals with Co^{60} gamma-ray and 1.3-Mev electron irradiations. These irradiations produced the colloid band, at 565 mμ, in the synthetic crystals but not in untreated natural crystals. Various thermal treatments were given the natural crystals prior to their coloration. It was found that either type of irradiation would produce colloids in crystals that had been heated at 700°C for at least 24 hours in an atmosphere containing hydroxyl ions. Colloids were produced in the untreated natural crystals by additive coloration. It was found that the characteristics of the colloids were the same whether they were produced by ionizing radiation or by additive coloration, with the exception of the role played by hydroxyl ions in the crystals colored by ionizing radiation. (auth)

Rare Earths and Rare-earth Compounds

139
THE IODIDES OF THORIUM(III), (II) AND (I). George W. Watt, D. M. Sowards, and S. C. Malhotra (Univ. of Texas, Austin). J. Am. Chem. Soc. 79, 4908-10(1957) Sept. 20.

The formation of iodides of thorium(III), (II), and (I) by the reduction of thorium(IV) iodide with excess elemental thorium at 550° is described. Procedures for the separation of the five components of the resulting reaction mixture have been devised; the resulting data confirm the existence of ThI_3 and provide evidence also for the existence of ThI_2 and ThI. (auth)

140
RARE EARTH NICKEL OXIDES. Aaron Wold, Benjamin Post, and Ephraim Banks (Lincoln Lab., Lexington, Mass.). J. Am. Chem. Soc. 79, 4911-13(1957) Sept. 20.

$LaNiO_3$, containing nickel in the trivalent state was prepared and its structure studied by x-ray diffraction methods. The dimensions of the rhombohedral pseudocell are $\alpha = 7.676 \pm 0.002$ A., $\alpha = 90°43'$. The dimensions of the primitive rhombohedral cell are $\alpha_p = 60°49'$, $a = 5.461$ A. The hexagonal form of this cell has the following dimensions, $a = 5.456$ A., $c = 13.122$ A. Neodymium oxide reacts with nickel(II) oxide, in the presence of sodium carbonate, to form a single phase whose composition may vary between $Nd_{1.67}Ni^{+2}_{0.72}Ni^{+3}_{0.41}O_{3.84}$ and $Nd_{1.75}Ni^{+2}_{0.57}Ni^{+3}_{0.43}O_{3.84}$. An increase in the ratio Nd : Ni results in the formation of more trivalent nickel. With the exception of one very weak line at $2\theta = 31.2°$, all the lines of the x-ray diffraction patterns out to $2\theta = 75°$ could be indexed satisfactorily on the basis of a monoclinic unit cell with $\alpha = 3.92$ A., $b = 6.16$ A., $c = 3.77$ A., and $\beta = 92.4°$. Samarium, gadolinium, and yttrium oxides do not appear to form stable compounds with nickel(II) oxide under the conditions used to form the other rare earth nickel oxides. The product of reaction between lanthanum oxide, samarium oxide and nickel(II) oxide, in the mole ratio 1 : 1 : 4, was a new phase, which seemed to be isomorphous with the phase obtained from the reaction of mixtures having compositions between $2NiO \cdot 1.5Nd_2O_3$ and $2NiO \cdot 1.75Nd_2O_3$. Mixtures having a 1 : 1 ratio of La : Nd showed the presence of the lanthanum nickel oxide and neodymium nickel oxide phases. At other ratios of La : Nd, x-ray data indicate extensive solubility of $LaNiO_3$ and neodymium nickel oxide. (auth)

141
THE VAPOR PRESSURE OF THULIUM METAL. F. H. Spedding, R. J. Barton, and A. H. Daane (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 5160-3(1957) Oct. 5.

The vapor pressure of Tm has been measured by two modifications of the Knudsen effusion method, covering the temperature region from 809 to 1219°K. The results may be expressed by eq. 3. This represents a heat of sublimation of −57.44 ± 0.20 kcal for this temperature region, which is somewhat lower than would be expected for a normal trivalent rare earth element, but appears reasonable for Tm in which the binding may perhaps be weaker due to the nearly filled 4f shell in this metal. (auth)

142
HEAT CAPACITY OF TERBIUM FROM 15 TO 350°K. L. D. Jennings, R. M. Stanton, and F. H. Spedding (Iowa State Coll., Ames). J. Chem. Phys. 27, 909-13(1957) Oct.

The heat capacity of terbium has been measured in the temperature range 15 to 350°K. A lambda anomaly has been observed with the peak at 227.7°K. There is, in addition, an anomalous region near 220°K. The heat capacity in this region depends on the thermal history of the sample . The value of the entropy at 273.16°K is 17.50 cal/(g atom-deg) in agreement with the value predicted on the assumption that at room temperature the 4f electrons have the same configuration as the free tripositive ion. (auth)

143
ABSORPTION, FLUORESCENCE, AND MAGNETIC PROPERTIES OF GADOLINIUM CHLORIDE ($GdCl_3 \cdot 6H_2O$). G. H. Dieke and L. Leopold (Johns Hopkins Univ., Baltimore, Md.). J. Opt. Soc. Amer. 47, 944-54(1957) Oct.

A study of the Zeeman effect of absorption lines of $GdCl_3 \cdot 6H_2O$ and its dependence on the orientation of the crystal has given the constants for the magnetic ellipsoids for the ground state and 11 excited states. Evidence is presented for identifying the first three absorption groups as transitions from ^8S to $^6P_{7/2}$, $^6P_{5/2}$, and $^6I_{7/2}$. The magnetic observations were made at 77, 4.2, and 1.7°K and field-free spectra also taken at 195 and 273°K. Very strong fluorescence is observed from the lowest excited state to the ground state. The magnetic axes are approximately but not exactly the same for all observed states. The direction of maximum susceptibility is not that of the twofold crystal axis but perpendicular to it. There are small but definite deviations from isotropic magnetic behavior for the ground state. (auth)

Separation Procedures

144 AERE-C/R-542
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INFLUENCE OF SULPHAMATE ON THE PARTITION OF NITRIC ACID BETWEEN WATER AND BUTEX. E. Busk and H. A. C. McKay. June 1950. Decl. with Amendment Nov. 1956. 14p.

The effect of (a) ammonium sulphamate and (b) sulphamic acid on the partition coefficient of nitric acid between butex and water has been determined, both in the absence and in the presence of 8N ammonium nitrate. A large part of the effect can be explained in terms of incomplete ionization of sulphamic acid, and pH titration curves of this acid indicate a dissociation constant of about the right magnitude. With sulphamic acid itself, however, there is an anomaly, and the partition data appear to conflict with the pH measurements. The suggestion is made that the amino-group in sulphamic acid may be very weakly basic. (auth)

145 HW-51663
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EFFECT OF SOME ORGANIC AMINES ON THE EXTRACTION BEHAVIOR OF RUTHENIUM. A. S. Wilson and H. D. Warren. July 22, 1957. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

In the product decontamination processes used at Hanford, a major portion of the Ru present as a fission product is removed either in the feed preparation cycle by oxidation to RuO_4 and subsequent volatilization, or in a co-decontamination cycle by solvent extraction. In each case, however, there is some Ru which escapes oxidation and extracts into the organic phase in the first column, along with U and Pu. This Ru is believed to be in the form of an aquo or nitrato derivative of nitrosylruthenium. The work presently reported is an investigation of a few of the many potential complexing agents which could possibly react with nitrosylruthenium to give coordination compounds that would not extract. (auth)

146 KAPL-1762
Knolls Atomic Power Lab., Schenectady, N. Y.
BUBBLE STIRRING IN A LOW TEMPERATURE MODEL OF A FUSED ELECTROLYSIS CELL. R. E. Coffman and L. W. Niedrach. June 28, 1957. 22p. Contract W-31-109-Eng-52. $0.75(OTS).

The rapid settling of the oxide feed in the KAPL process for electrowinning U from its oxides causes operating problems. The possibility of making use of the anodically generated gases to stir the bath is considered as a means of overcoming the settling problem. Effects of variables on the efficiency of such stirring are described. (auth)

147 NAA-SR-1997
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SEPARATIONS CHEMISTRY QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1957. G. E. Brand, A. G. Buyers, W. J. Gardner, and E. E. Motta. Sept. 30, 1957. 25p. Contract AT-11-1-GEN-8. $0.75(OTS).

Two multikilogram scale remotely operated experiments using irradiated and natural U were conducted to study fission product removal by oxide drossing. Analytical results are not yet available. The diffusion coefficient of Ce in molten U was found to be 1×10^{-4} cm²/sec at 1200°C. A series of nonconsumable electrode arc melting experiments using Th–U alloys has been completed showing that Pa and U can be evaporated at temperatures over 2000°C. Thorium was electrolyzed from molten salt baths by using an Fe cathode and a molten Zn anode. A theoretical equation was derived relating the decontamination factor to the standard electrode potentials of Th and other elements. (auth)

148 ORNL-1918
Oak Ridge National Lab., Tenn.
USE OF THE HIGGINS CONTINUOUS ION EXCHANGE CONTACTOR IN RECOVERING URANIUM FROM AQUEOUS SLURRIES. I. R. Higgins. Oct. 11, 1956. Decl. Sept. 9, 1957. 55p. Contract W-7405-eng-26. $1.50(OTS).

Flowsheets are presented for recovering U from unfiltered H_2SO_4—or carbonate-leached ore pulps, at a rate of 100 tons of ore per day, in a Higgins continuous ion-exchange contactor. In the experimental work on which the flowsheets were based, approximately 5 ft of Permutit SK-20 was required to maintain a U loss of less than 1% with resin U loadings of 40 to 50 g/liter and feed flow rates of 300 to 600 gal/hr/ft², or with 20 g/liter and a flow rate of up to 900 gal/hr/ft². When the loading was 30 g/liter or more, a higher column was required as the flow rate in-

creased, but resin loading was more important than flow rate in determining the column height. Loading column data indicated almost identical performance of the 2-, 6-, and 12-in.-dia contactors. With the sulfate-loaded resin, product U concentrations were 60 g/liter with the 5M NaCl—water elution scheme, 15 g/liter with 1M NaCl eluant, and 20 g/liter with 1M NH_4NO_3 eluant. Reagent consumptions were 0.5 lb of NaCl, 3.5 lb of NaCl, and 4 lb of NH_4NO_3, respectively, per pound of U. The elution efficiency of recycled NH_4NO_3 was reduced because of sulfate accumulation. The 5M NaCl was recovered for reuse by removing sulfate with 1.5 lb of $CaCl_2$ per pound of U processed. With the carbonate-loaded resin, elution with 1M $NaHCO_3$ gave a product containing 25 g of U per liter and used 1.5 lb of $NaHCO_3$ per pound of U. With pulps containing 10% suspended solids, 10-20 mesh resin was satisfactory when less than 1% of the solids was sand greater than 200 mesh. With 5% pulps, 20-40 mesh resin was used when less than 1% was greater than 325 mesh. (auth)

149 ORNL-2251

Oak Ridge National Lab., Tenn.

CHEMICAL TECHNOLOGY DIVISION MONTHLY PROGRESS REPORT [FOR] JANUARY 1957. June 18, 1957. Decl. July 10, 1957. 74p. Contract W-7405-eng-26. $2.00(OTS).

Feed Materials Processing. Brief descriptions of the separation of $ThHg_3$, scrubbing of product amalgams with fused $AlCl_3$–NaCl or $ZnCl_2$ to remove byproducts, and the extrusion of Th billets produced by the Metallex Process are given. The kinetics of UF_4–C pellets with dry O_2 in the Fluorox Process are described. Iron was found to be effective for reducing uranyl ion to uranous in the Excer Process. Uranium was successfully recovered from F^--containing scrap in a 2 in. Higgins continuous ion-exchanger contactor. Heterogeneous (Power) Reactor Fuel Processing. In the Fused Salt–Fluoride Volatility Process the stainless steel charge melt vessel corroded excessively and a new Ni vessel is being fabricated as a replacement. Performance of various equipment in the Darex Process is discussed. The presence of carbonaceous impurities in the HCl gas used in the Zircex Process apparently increased the insoluble losses. Decontamination factors are given in the initial Hermex Process U run. A third U cycle and additional Pa and U^{233} storage systems are being added to the Thorex Process Pilot Plant. Homogeneous Reactor. Design and installation of the fuel processing plant were completed. General Chemical and Engineering Studies. The storage of long and short-lived isotope wastes are given. Iron, as a stand-in for Pu, was removed from a U stream by Dowex 50 ion-exchange resin. Miscellaneous studies are included. (W.L.H.)

150 ORNL-2366

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR MAY 1957. Chemical Technology Div. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. Sept. 27, 1957. 30p. Contract W-7405-eng-26. $0.75(OTS).

Systematic Studies. A mixed n-octyl-n-decyl tertiary amine, commercially available in development quantities, appeared promising for process use. Its U extraction power was similar to that of tri-n-octylamine, and loss by distribution to a sulfate liquor was lower. A corresponding secondary amine was similar in extraction behavior to di-n-decylamine, but loss by distribution was higher. Screening tests of U extraction power from dilute acid test solutions are summarized for various organophosphorus compounds, with principal attention to dialkylphosphinic acids, monoalkylphosphonic acids, and some polymeric compounds. Unusually high U extraction power was shown by an α-hydroxy phosphinic acid, phenyl(1-hydroxy-2-ethylhexyl)phosphinic acid. Uranium(IV) was extracted strongly from dilute acidic sulfate solution by a primary and a secondary amine, but not by a tertiary amine. It was extracted more strongly than U^{6+} from hydrochloric acid solutions by di(2-ethylhexyl)phosphoric acid (D2EHPA). In contrast to U^{6+}, U^{4+} extraction by D2EHPA was enhanced little if any by the presence of TBP. Process Development. In tests with tri-iso-octylamine, a number of diluent additives were tested for ability to prevent separation of amine heteropolymolybdate precipitates from the usual kerosene-alcohol diluent during the chloride stripping cycle. Addition of nitrobenzene at 100 g/liter was effective for this purpose. In other tests, several of the Mo precipitates were separated and analyzed for amine, Mo, phosphate, and V content. The amount of Mo reporting to U products from the Dapex process varied with the method and conditions by which uranium was precipitated from the sodium carbonate strip solution. Direct caustic precipitation of the U gave products essentially free of Mo although filtration characteristics of the precipitate were poor. When the U was recovered by first acidifying with H_2SO_4 and then precipitating with NH_3, most of the Mo remained in the product even when an excess of ammonia was used. Recovery by acidification and precipitation with caustic resulted in better Mo decontamination, particularly when an appreciable excess of caustic was added. Engineering Studies. The rate of U extraction from a synthetic H_2SO_4 leach liquor by a Dapex-type organic was proportional to the cube root of power input and was slightly faster in a 12-in. than in a 6-in. mixer at the same power input per unit volume. At a given power input the rate increased with decreased turbine diameter. Location of the turbine at one diameter from the bottom of the mixer tank provided only slightly faster extraction than at a center location. (For preceding period see ORNL-2346.) (auth)

151 ORNL-2380

Oak Ridge National Lab., Tenn.

PROGRESS REPORT ON RAW MATERIALS FOR JUNE 1957. Chemical Technology Div. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. Oct. 17, 1957. 36p. Contract W-7405-eng-26. $1.00(OTS).

Some new organonitrogen compounds are described, and U extraction power in standard tests and reagent loss by distribution to an aqueous solution is reported. Preliminary attempts to adapt the Amex Process to treatment of ore leach slurries resulted in excessive volume losses of the organic phase and preferential loss of amine from the diluent. Uranium extraction isotherms were determined for two new tertiary amine samples. The stage efficiency of a baffled tank mixer for extraction of U by di(2-ethylhexyl) phosphoric acid in 97% kerosene–3% TBP from a solution of typical composition increased with increased impeller speed at fixed residence time, ranging from 14% at 150 rpm to 92% at 1170 rpm in 4.8 min. Measurement of light scattering by amine species in benzene solution is described. (For preceding period see ORNL-2366.) (W.L.H.)

152 ORNL-2382

Oak Ridge National Lab., Tenn.

THE SOLVENT EXTRACTION OF IRON WITH TRI-N-OCTYLPHOSPHINE OXIDE. W. J. Ross and J. C. White. Sept. 26, 1957. 23p. Contract W-7405-eng-26. $0.75 (OTS).

The extraction of Fe from acidic solutions with tri-n-octylphosphine oxide (TOPO) was investigated. Iron is extracted only when the Fe is in the trivalent oxidation

state and sufficient chloride ion is present in solution. Quantitative extraction was observed when the solution was at least 4 M or 1 M HCl–3 M NaCl. The loading capacity of 0.5 millimole of TOPO is approximately 16 mg of Fe from 7 M HCl. Quantitative extraction of 12 mg of Fe from 7 M HCl is possible in a single equilibration. Under these conditions extraction is quantitative at phase ratios as large as 20 to 1. The extracted species are probably $FeCl_3$ and $HFeCl_4$. (auth)

153 RCTC/P-82

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SELECTION OF A HIGH TEMPERATURE PROCESS FOR EXTRACTING PLUTONIUM FROM IRRADIATED URANIUM. K. M. Towers and F. Roberts. Nov. 1956. 14p.

A comparative study of pyrometallurgical methods for extracting Pu from U metal points to the use of molten Mg metal. The Pu is recovered by distilling away the Mg. (auth)

154 TID-7534

Atomic Energy Commission, Washington, D. C.

PAPERS PRESENTED AT THE BELGIUM SYMPOSIUM ON CHEMICAL REPROCESSING, BRUSSELS, MAY 20-24, 1957. (Issued in three books: (Bk. 1), 481p.; (Bk. 2), 331p.; and (Bk. 3), 364p.) $10.50(OTS).

The papers of the three sessions recorded in book one deal with aqueous reprocessing, auxiliary processes, and disposal of plant effluents. In Aqueous Reprocessing, typical chemical processes for dissolving and preparing relatively simple fuel elements (Al clad or canned) for solvent extraction treatment are discussed. Typical chemical and process flowsheets for solvent extraction separation and decontamination of U–Pu in natural U, U^{233}–Th from Th, and enriched U from U–Al alloy are presented. Performance characteristics of packed columns in Redox Process, and pulse columns and mixer-settlers in Purex Process are given. Auxiliary Processes are those dealing with unusual fuels, converting them to solutions amenable to solvent extraction. The most widely proposed diluents and claddings for these power reactor fuels are Zr and stainless steel, and the various methods for dissolving them are surveyed. Also described as auxiliary processes are methods for additional decontamination from Ru, Zr, and Nb, for concentrating dilute U^{233} and Pu, and for calcining UNH to UO_3 and converting $Pu(NO_3)_4$ to metal. In Disposal of Plant Effluents the methods used for treatment, concentration, storage, and dispersal of gaseous, liquid, and solid wastes from radiochemical processing plants are summarized. After waste disposal problems are treated in general, the treatment of gaseous effluents, preparation of waste for liquid disposal, and the retention of high level radioactive wastes are discussed. The problems of ultimate disposal of radioactive waste to the environment are surveyed with consideration of the development of a nuclear power economy during the next fifty years. Unit costs and economic relationships for some of the better understood stages of the general scheme of waste disposal are derived. Book two, entitled Nonaqueous Processing deals with fluoride volatility processes and pyrometallurgical or pyrochemical processes. The latter involves either an oxide drossing or molten metal extraction or fused salt extraction technique and results in only partial decontamination. Fluoride volatility processes appear to be especially favorable for recovery of enriched U and decontamination factors of 10^7 to 10^8 would be achieved by simpler means than those employed in solvent extraction. Data from lab research on the BrF_3 process and the ClF_3 process are given and discussed and pilot plant experience is described, all in connection with natural U or slightly enriched U processing. Fluoride volatility processes for enriched or high alloy fuels are described step by step. The economic and engineering considerations of both types of nonaqueous processing are treated separately and as fully as present knowledge allows. A comprehensive review of the chemistry of pyrometallurgical processes is included. Engineering and Economics is the title of book three which is concerned with several phases of chemical reprocessing of fuels which are of a general nature. Hot labs, radiochemical analytical facilities, and high level development cells are described. Dissolution equipment, contactors, flow generation, measurement, and control equipment, samplers, connectors, carriers, valves, filters, and hydroclones are described and discussed. Papers are included on: radiation safety, chemical safety, radiochemical plant operating experience in the U. S., and heavy element isotopic buildup. The general economics of solvent extraction processing is discussed, and capital and operating costs for several U. S. plants given. The Atomic Energy Commission's chemical processing programs and administration are evaluated and the services offered and charges therefor are listed. (T.R.H.)

155 WAPD-PWR-CP-2164

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

EVALUATION OF MONTMORILLONITE CLAY FOR USE IN DECONTAMINATION OF PWR RADIOACTIVE WASTE LIQUORS. R. Ehrenreich. [Feb. 14, 1957]. 11p. $3.30 (ph OTS); $2.40(mf OTS).

156 WIN-30

National Lead Co. Raw Materials Development Lab., Winchester, Mass.

RECOVERY OF URANIUM FROM LAKEVIEW LEACH LIQUOR USING TRILAURYLAMINE. Oscar A. Nietzel, Charles F. Lubinger, and John C. Apidianakis. Sept. 11, 1957. 15p. Contract AT(49-6)-924. $3.30(ph OTS); $2.40(mf OTS).

Data are presented demonstrating that U can be economically recovered from Lakeview leach liquor using a solvent extraction technique with no pretreatment of the leach liquor to decrease the Mo content. The solvent extraction technique uses trilaurylamine for the U extractant and a 1M NaCl–0.05M H_2SO_4 stripping reagent. (auth)

157

PURIFICATION OF THE ACTIVE DEPOSIT OF OLD RADIOEMANATION AMPOULES. C. Ferreira de Miranda. Faculty of Sciences in Lisbon B3, 191-5(1957). (In Portuguese)

158

THE SEPARATION OF ZIRCONIUM AND HAFNIUM BY DIFFERENTIAL REDUCTION OF THEIR TETRACHLORIDES. I. E. Newnham (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). J. Am. Chem. Soc. 79, 5415-17(1957) Oct. 20.

If crude $ZrCl_4$, containing $HfCl_4$, is heated with Zr powder in vacuo at 400 to 450°C, most of the $ZrCl_4$ is reduced to the comparatively involatile trichloride. The $HfCl_4$ is not reduced and, together with any unreduced $ZrCl_4$, can be recovered by sublimation as a Hf concentrate with a Hf/Zr ratio higher than 10%. The residual $ZrCl_3$ in which the original Hf/Zr ratio of the crude chloride has been reduced from 2% to less than 0.05%, can be disproportionated at 550°C to give $ZrCl_4$ with a correspondingly low Hf content. Factors controlling the reduction process are discussed, and a separation technique is outlined. (auth)

159

CHROMATOGRAPHIC SEPARATION OF IRON, TITANIUM, ZIRCONIUM, AND HAFNIUM. B. Edmée Marques and M. Regina Grade. Las Ciencias, de Madrid 21, No. 3, 9p. (1957). (In Portuguese)

The metallic ions enclosed in mixtures of zirconium perchlorates (plus hafnium) and of iron, and likewise in titanium and iron perchlorates, were fixed in columns of amberlite IR-105, and were eluated with water solutions of HCl, 6N in pre-established laboratory conditions for each of the ions in cause. It was seen that iron is easily separated both from titanium and from zirconium (plus hafnium) passing completely with the first millilitres of effluent and that, in the case of zirconium, three maxima appear, two of which are rather remote from the first, which are due to the zirconium and to the hafnium. (auth)

160

CHEMICAL REPROCESSING. S. Lawroski (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 9, 140-1 (1957) Sept.

Fuel element processing loads expected from the various military propulsion and civilian power reactors are discussed. The status of developmental work on volatility and pyrometallurgical processes is discussed. Waste disposal studies are briefly reviewed. (C.H.)

Spectroscopy

161 AERE-Lib/Trans-712

SHAPE AND WIDTH OF LINES IN D. C. ARC SPECTRA. V. F. Kitaeva and N. N. Sobolev. Translated by R. C. Murray from Optika i Spektroskopiya 1, 302-20(1956). 22p.

The shape and width of the Na 5890, 6160.7, 5153.4, 4571.8, 8194.8, 5688.2, and 4982.8 A lines with square (quadratic) Stark effect, from a d-c arc burning at atmospheric pressure in air have been investigated. The experimental results are compared with the predictions of the collision and statistical theories of line-broadening. It is shown that the shape of the lines with a Van-der-Waals constant of 10^{-32} to 10^{-30} and constant of the quadratic Stark effect $C_4 < 3.10^{-14}$ is symmetrical and is produced by collision of the radiating atoms with air molecules and by the Döppler effect (Na 5890 A and Tl 5350 A). The shape of the lines with the same limits for the Van-der-Waals constant, but with the quadratic Stark effect constant 10^{-13}-3.10^{-14} is likewise symmetrical and is determined by collisions of the radiating atom with molecules of air and of the electrodes, and by the Döppler effect (6160.7 and 8194.8 A lines). A line with $C_4 > 10^{-13}$ is asymmetrical, and these lines begin to be affected by the statistical widening of the arc ion plasma; the collision theory with allowance for Döppler effect describes the intensity distribution in the short-wave wing, while the distribution in the long wave wing is described by the statistical theory (lines 5163.4, 4751.8, 5688.2, and 4982.8 A). (auth)

162

VIBRATIONAL SPECTRUM AND STRUCTURE OF METAL-CYANIDE COMPLEXES IN THE SOLID STATE. III. $Hg(CN)_2$. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 665-8(1957) Sept.

The infrared spectra of solid $Hg(CN)_2$ and the mono- and di-substituted C^{13} and N^{15} species have been observed. The polarized spectrum of a single crystal of the normal species was also observed. The seven fundamental vibrations of the linear, symmetric $Hg(CN)_2$ molecule have been assigned at 2192, 415, 2193.5, 442, 276, 341, and ca 100 cm^{-1}. From the observed frequencies of the normal and isotopic species, force constants were calculated for two possible structures: N-C-Hg-C-N and C-N-Hg-N-C. It is shown that the latter structure gives unreasonably large values for the CN stretching force constant (> 20 md/A) and the CN, HgN interaction constant (~2.4 md/A), while the former structure yields quite reasonable force constants, namely: FCN = 17.6, FHgC = 2.61, FCN, C'N' = -0.1, FHgC, HgC' = 0.1, and FHgC, CN = 0.1 md/A. These results are presented as strong evidence that the cyanides are bound to the mercury through carbon atoms. (auth)

163

INFRARED SPECTRUM AND FORCE CONSTANTS OF THE NITRITE ION. Ralph E. Weston, Jr. and Thomas F. Brodasky (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 27, 683-9(1957) Sept.

The infrared spectra of the following compounds have been investigated: microcystalline $NaNO_2$, KNO_2, and $AgNO_2$; and aqueous solutions of $NaNO_2$ and KNO_2. The spectra of N^{15}-labeled compounds have also been obtained. The spectrum of the high-temperature modification of $NaNO_2$, which exists above 160°, has been observed. The fundamental frequencies for NO_2^- (in crystalline $NaNO_2$) are: $\nu_1(a_1) = 1328 \pm 2$ cm^{-1} (N^{14}), 1303 ± 2 (N^{15}); $\nu_2(a_1) = 828.2 \pm 0.4$ (N^{14}), 823.6 ± 0.4 (N^{15}); $\nu_3(b_1) = 1261 \pm 3$ (N^{14}). These are used to calculate the following force constants, in units of millidynes/A: $f_d = 7.69 \pm 0.10$, $f_\alpha/d^2 = 1.75 \pm 0.04$, $f_{dd} = 1.94 \pm 0.13$, $f_{d\alpha}/d = 0.505 \pm 0.113$. (auth)

Syntheses

164 NP-6437

Wyandotte Chemicals Corp., Wyandotte, Mich.

SYNTHESIS AND EVALUATION OF HIGH TEMPERATURE STABLE AND NUCLEAR RADIATION STABLE METAL-CYCLOPENTADIENYL FLUIDS. Quarterly Progress Report No. 2 Covering Period June 1, 1957 to August 31, 1957. Sept. 25, 1957. 21p. Project 105-R722. Contract AF33(616)-5053.

Crude 1,1'-di(pentamethyldisiloxanyl)ferrocene was synthesized as a representative of the hitherto unreported disiloxanyl ferrocenes. The intermediates, chlorocyclopentadienyldimethylsilane and cyclopentadienylpentamethyldisiloxane, were prepared in impure form; hydrolysis of the chlorosilane was not straight-forward. Ethoxybromocyclopentene, a new potential intermediate to ethoxyferrocenes, was synthesized in good yield by the action of N-bromosuccinimide on cyclopentadiene. Efforts to convert dibromocyclopentene to alkoxycyclopentadienes were unsuccessful. (For preceding period see NP-6344.) (auth)

165 NYO-2055

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

THE ENZYMATIC PHOSPHORYLATION OF DEOXYRIBONUCLEOTIDES. Milton M. Mozen and Paul S. Lavik. Aug. 1, 1957. Contract W-31-109-eng-78. $0.50(OTS).

Tracer Applications

166 AERE-GP/R-2166

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

VAPOUR PRESSURE DIFFERENCES BETWEEN SOME OF THE ISOTOPIC SPECIES OF CARBON MONOXIDE, METHANE AND OXYGEN. PART I. EXPERIMENTAL. T. F. Johns. Jan. 1957. 56p.

Direct determinations were made of the differences between the vapor pressures of a number of samples of carbon monoxide containing different proportions of $C^{12}O^{16}$, $C^{13}O^{16}$, and $C^{12}O^{18}$, and from these the vapor pressure ratios of the three species were calculated. Similar measurements were made for methane and oxygen. The differences between the melting and transition points of the different isotopic species were also measured. (C.H.)

167

STUDYING THE DIFFUSION OF AQUEOUS VAPOURS IN SYNTHETIC MATERIALS BY MEANS OF TRITIUM. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/34. E. E. Finkel. London, Pergamon Press, Ltd., 1957. 13p.

A new method is described for measuring the coefficients of aqueous vapor diffusion through polymeric membranes by means of water labelled with tritium. (auth)

168

EXCHANGE REACTION BETWEEN URANIUM IONS IN A HYDROCHLORIC ACID SOLUTION. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/39. Elizabeth Rona. London, Pergamon Press, Ltd., 1957. 7p. (In French)

Exchange reactions with heavy isotopes have received increased attention in recent years. Several theories have been advanced to explain the paths through which electron transfer can occur. There are but very few heavy element systems which will lend themselves for the experimental tests of these problems. The exchange between uranium ions in hydrochloric acid solution, however, proceeds with measurable speed. The following two systems were studied: (1) $U^{+4} + U^{*}O_2^{+2} = U^{*+4} + UO_2^{+2}$ and (2) $UO^{+2} + U^{*}O_2^{+2} = U^{*}O^{+2} + UO_2^{+2}$. Experimental data show that the rate of exchange is first order with respect to UO_2^{+2} concentration in (1) and (2) and second order in respect to U^{+4} in (1) and UO^{+2} in (2). It is −3 order with respect to pH in (1) and −3.7 in (2). The rate of exchange is considerably faster for (2) than for (1). The mechanism proposed for (1) and (2) is naturally somewhat different, but in both an activated complex ion is postulated with an oxygen bridge between the two uranium ions. The energy of activation of reaction (2) is lower. The entropy of activation is less positive than for (1). A hypothesis is advanced to account for these results. [The ion with asterisk is labelled with U^{233}.] (auth)

Transuranic Elements and Compounds

169 JENER-51

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

WAVELENGTH AND INTENSITY MEASUREMENTS IN THE SPARK EXCITED SPECTRUM OF PLUTONIUM. J. Haaland. Aug. 1957. 21p.

The wavelength of some four hundred Pu lines were measured with a Zeiss Abbe-comparator with an estimated accuracy of ± 0.01 A. The spectrograms were obtained with a 21 ft 15000 lines per inch grating spectrograph. Relative intensities of most of the lines were measured photometrically. The spectral sensitivity of the photoplates have been taken into account, and all lines are corrected for background. (auth)

170

CRYSTAL STRUCTURE OF ALPHA-PLUTONIUM METAL. W. H. Zachariasen (Univ. of Chicago, Ill.) and Finley Ellinger (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 811-12(1957) Sept.

171

MAGNETIC SUSCEPTIBILITIES OF SOME Pu^{+4} COMPOUNDS. W. Burton Lewis (Los Alamos Scientific Lab., N. Mex.) and Norman Elliott (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 27, 904-8(1957) Oct.

The magnetic susceptibilities of $Pu(SO_4)_2 \cdot 4H_2O$, $Rb_4Pu(SO_4)_4 \cdot 2H_2O$, $Pu(C_2O_4)_2 \cdot 6H_2O$, $[(CH_3)_4N]_2$-$PuCl_6$, and PuF_4 have been measured over the temperature range 77 to 334°K. The large departures from the Curie-Weiss law observed in these salts are discussed in terms of the crystalline field symmetry. (auth)

Tritium and Tritium Compounds

172

STUDIES OF THE TRITIUM LABELING REACTION. III. ALCOHOLS AND ACETONE. Wilford J. Hoff, Jr. and F. S. Rowland (Princeton Univ., N. J. and Univ. of Kansas, Lawrence). J. Am. Chem. Soc. 79, 4867-72(1957) Sept. 20.

The reactions of tritium from the $Li^6(n,\alpha)H^3$ nuclear reaction have been studied in methyl alcohol, ethyl alcohol and acetone. All of the important nongaseous products can be formed in a reaction involving the tritium atom and a single solvent molecule. In these solvents, the most important reactions leading to nongaseous products are (1) $T + \equiv C-H \rightarrow \equiv C-T + \ldots$; (2) $T + \equiv C-CH_3 \rightarrow \equiv C-T + \ldots$; (3) $T + -CH_2OH \rightarrow -CTO + \ldots$; (4) $T + >C=O \rightarrow$ $T-\underset{|}{\overset{|}{C}}-OH$; (5) $T + =O \rightarrow -OT$, $T + -O- \rightarrow -OT$. (auth)

Uranium and Uranium Compounds

173 AERE-M/M-156

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

INCLUSIONS IN URANIUM METAL. K. E. G. Meredith and M. B. Waldron. May 1957. 18p.

The available evidence on the occurrence and identity of inclusions due to C, O, N, H, Fe, Si, and Al in U is reviewed in conjunction with observations. Apparently divergent views on interpretation can be reconciled by postulating that absolutely pure UO, UN, or UC do not exist in normal U metal, but that due to their isomorphism they occur as a complex designated U(O,C,N). Oxygen, C, or N can predominate in U(O,C,N) depending on the composition and thermal history of the metal. Although a broad basis has been established for the identification of inclusions in U, precise details of the composition is not always possible of either U(O,C,N) or the differentiation of the precipitates formed by the U−Fe, U−Si, and U−Al compounds. Uranium hydride and CaF_2 or MgF_2 can be identified with fair certainty when in sufficient quantity. (auth)

174 HW-51084(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A MARTENSITIC REACTION FOR URANIUM. A. L. Bement and W. P. Wallace. June 25, 1957. 26p. Contract W-31-109-Eng-52. $0.75(OTS).

Hardness measurements of specimens quenched from the $\beta \rightarrow \alpha$ phase at different cooling rates support the proposed martensitic $\beta \rightarrow \alpha$ transformation for uranium. Specimens held in 635 and 600°C isothermal baths prior to subsequent quenching to −5°C require more than 10 and two seconds, respectively before diffusion mechanisms for $\beta \rightarrow \alpha$ transformation commence. Once started, about 500 seconds are required to complete transformation by diffusion at these temperatures. Specimens quenched prior to this hold time

transform in part martensitically. Relationships are calculated for hardness as a function of grain size and cooling rate, and for grain size as a function of cooling rate. Metallographic examination confirms the hardness trends and reveals that widely varied grain structures can be produced by controlled cooling from the β phase. Finally, a schematic time-temperature-transformation curve is sketched from the hardness data obtained. (auth)

175 KAPL-1761

Knolls Atomic Power Lab., Schenectady, N. Y.

ELECTROWINNING OF URANIUM FROM ITS OXIDES. I. LABORATORY STUDIES. L. W. Niedrach and B. E. Dearing. Apr. 30, 1957. 54p. Contract W-31-109-Eng-52. $1.50(OTS).

The background work is described for a new continuous process for the production of U by electrolytic reduction of U oxides in fused salt electrolytes. Unlike past electrolytic processes for U production, the present one is operated at temperatures which are above the melting point of U. The effect of current, salt bath composition, and other variables on efficiency and cell operation are discussed. The advantages of the new process are outlined, and the areas requiring additional development work are indicated. (auth)

176 NLCO-677

National Lead Co. of Ohio, Cincinnati.

MEASUREMENT OF REAL DENSITY OF POWDERED ORANGE OXIDE (UO_3). Jack F. Blum and Eugene J. Beer. Feb. 5, 1957. 15p. Contract AT(30-1)-1156. $0.75(OTS).

177 NYO-6313

Syracuse Univ., N. Y. Research Inst.

THERMAL STABILITY OF THE HYDRATES OF URANYL NITRATE. Final Report. A. J. King, Ralph Pfeiffer, and William Zeek. Aug. 1, 1957. 28p. Contract AT(30-1)-1490. (SURI-Chem-242-578F). $4.80(ph OTS); $2.70 (mf OTS).

The progress of the thermal decomposition of uranyl nitrate hexahydrate through to the end product, UO_3, with identification of intermediate phases by appropriate chemical and physical methods is reported. A number of the compounds which could appear as intermediate phases in the decomposition process and whose existence have been fairly well established were prepared in pure form for use as standards of reference. Among these were $UO_2(NO_3)_2 6H_2O$, $UO_2(NO_3)_2 3H_2O$, $UO_2(NO_3)_2 2H_2O$ preparations, and various forms of the monohydrate of UO_3. X-ray-diffraction patterns were prepared for these substances. Vapor pressure measurements at 0°, 25°, and 50.1°C were made of the hydrate pairs, $UN \cdot 6H_2O$–$UN \cdot 3H_2O$ and $UN \cdot 3H_2O$–$UN \cdot 2H_2O$. The method of Baxter and Lansing was used with extrapolation to zero flow-rate in order to reduce errors due to non-equilibrium conditions. A series of studies was made of the end products formed during thermal decomposition of both $UN \cdot 6H_2O$ and $UN \cdot 3H_2O$ at a number of different temperatures. Preliminary studies of the products present at different stages in the cycle of heating of $UN \cdot 6H_2O$ were made by x-ray methods. The only products which were definitely identified were $UN \cdot 6H_2O$, $UN \cdot 3H_2O$, and $UN \cdot 2H_2O$. The end product after heating for four hours and twenty minutes was amorphous. Unidentified diffraction lines appeared in the intermediate products along with $UN \cdot 3H_2O$ and $UN \cdot 2H_2O$, respectively. These lines may be due to one or more of the several polymorphic forms of UO_3 or $UO_3 \cdot H_2O$. Only one form of each of these has been observed in the course of this investigation, and their patterns did not agree with those of the unknown intermediate. (auth)

178 TID-7531(Pt. 1)

Division of Nuclear Materials Management, AEC and Chicago Operations Office, AEC.

MODERN APPROACHES TO ISOTOPIC ANALYSIS OF URANIUM. A Conference Held at Chicago, February 5-7, 1957. 180p. $4.75(OTS).

Topics discussed include: the precision and cost of spectrometer analyses; optical methods of isotope assay; uranium isotopic analysis with a prism-Echelle spectrograph; $U^{235-238}$ assay on the direct-reading optical spectrograph; the isotopic determination of U^{235} at low concentrations by means of Echelle spectroscopy; the spectrochemical determination of U^{235}; narrow wavelength interval direct reading spectrometer; the isotopic analysis of U by neutron activation analysis; determination of U^{235} by neutron activation; isotopic analysis of U with the 100-channel analyzer; the determination of U^{235} by fission counting; a non-destructive method for fuel assaying; quantative determination of U^{235} by delayed neutron counting; and the availability of neutron sources. (C.H.)

179 AEC-tr-3055

THE SOLUBILITY OF URANYL AND THORIUM PHOSPHATES. V. G. Chukhlantsev and S. I. Stepanov. Translated from Zhur. Neorg. Khim. 3, 478-84(1956). 9p.

A study was made of the solubility of uranyl and thorium phosphates in weak-acid solutions and the solubility product found from the solubility data. (W.L.H.)

180

THE OXIDATION OF A COMPLEX URANIUM SALT IN ALKALINE SOLUTION. Henri Martin-Frère. Compt. rend. 245, 848-50(1957) Aug. 19. (In French)

The reaction of hydrogen peroxide with U salts in the presence of an excess of alkaline carbonate produces a red-orange solution. Spectrophotometric studies indicate the formation of a peroxide complex as a result of the reaction between an H_2O_2 molecule and a U atom. The equilibrium constant, indicating the stability of the compound, was determined. (tr-auth)

181

AN IMPROVED PROCESS FOR THE PRODUCTION OF URANIUM METAL. 2. WET REDUCTION. 3. PRECIPITATION. A. Cacciari, R. De Leone, C. Fizzotti, and M. Gabaglio (CISE Labs., Milano). Energia nucleare (Milan) 4, 307-14(1957) Aug.

Aqueous solutions of $UO_2(NO_3)_2$ coming from the solvent extraction plant and transformed to chlorides, sulfates or fluorides by ion exchange are reduced to uranous state by zinc. A double fluoride of uranium and sodium (or ammonium or calcium) is then precipitated from the reduced solutions. The best operating conditions for a pilot plant both for reduction and precipitation are discussed. Purity of the products obtained in these investigations is also given. (auth)

182

PROCESSING VARIABLES, REACTIVITY, AND SINTERABILITY OF URANIUM OXIDES. D. A. Vaughan, J. R. Bridge, A. G. Allison, and C. M. Schwartz (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 49, 1699-1700(1957) Oct.

Current interest in the application of uranium dioxide as a reactor fuel has stimulated investigation of methods which yield oxide bodies of high density. One objective of this investigation is to produce an oxide powder that can be fabricated into shapes having at least 90% of theoretical density by forming at moderate pressures and temperatures — about 20,000 pounds per square inch and 1650°C. (auth)

183
ORGANIC COMPOUNDS OF URANIUM. VII. URANYL ALKOXIDES AND DITHIOCARBAMATES. R. G. Jones, E. Bindschadler, G. A. Martin, Jr., J. R. Thirtle, and H. Gilman (Iowa State Coll., Ames). J. Am. Chem. Soc. 79, 4921-2(1957) Sept. 20.

Several uranyl dialkyldithiocarbamates, uranyl ethoxide, and a compound thought to be uranyl t-butoxide are described. (auth)

184
THE REACTION OF URANIUM TETRAFLUORIDE WITH CALCIUM SULFATE. Mark T. Robinson (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 5418-19 (1957) Oct. 20.

Uranium tetrafluoride has been observed to react readily with calcium sulfate at temperatures above 630°C, forming CaF_2, U_3O_8, SO_2, and SO_3. (auth)

185
A STUDY OF THE REACTION: $2UF_4 + O_2 \rightarrow UF_6 + UO_2F_2$. I. SIDE REACTIONS AND THERMODYNAMICS. L. M. Ferris (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 5419-21(1957) Oct. 20.

The reaction of UF_4 with dry O_2 has been investigated in the temperature range of 600 to 900°C. In addition to the expected products, UF_6 and UO_2F_2, UF_5 was isolated from the system, and is postulated to be the product of a side reaction between UF_6 and UF_4. Only slight decomposition of UO_2F_2 was observed in this temperature range in accordance with thermodynamic predictions. (auth)

186
MAGNETIC SUSCEPTIBILITIES OF URANIUM(IV) IONS IN CUBIC CRYSTALLINE FIELDS. Clyde A. Hutchison, Jr. and George A. Candela (Univ. of Chicago, Ill.). J. Chem. Phys. 27, 707-10(1957) Sept.

The magnetic susceptibility arising from the electrons outside closed shells of U^{+4} in ditetramethylammonium uranium hexachloride is found to be 19.31×10^{-4} cm^3 $mole^{-1}$ independent of temperature from room temperature down to the triple point of H_2. This result is discussed in terms of a ground state configuration f^2 perturbed by the crystalline field. The measurements of others on uranium dioxide are also considered. (auth)

187
CASTING LARGE INGOTS OF URANIUM. G. W. P. Rengstorff and H. W. Lownie, Jr. (Battelle Memorial Inst., Columbus, Ohio). Metal Progr. 72, No. 3, 76-8 (1957) Sept.

Sound ingots, 7 in. diameter, weighing 1200 lb and with 91 to 95% recovery in metal, can be cast in iron molds after induction melting the uranium "derbies" in magnesia or graphite crucibles under open argon atmosphere. A small amount of barium chloride, added shortly before pouring, protects the stream of molten metal from oxidation. (auth)

188
URANIUM AND ITS ALLOYS. R. W. Nichols (Culcheth Labs., U.K.A.E.A.I.G.). Nuclear Eng. 2, 355-64(1957) Sept.

The mechanical, physical, chemical, and metallurgical properties of U are given in tabular and graphic form. Selected values for these properties are given, and the effects of radiation, thermal cycling, fabrication history and alloy additions are discussed. (T.R.H.)

189
NUCLEAR ENGINEERING DATA SHEET. NO. 1. URANIUM. Nuclear Eng. 2, 364a-5(1957) Sept.

The mechanical, chemical, physical, nuclear and metallurgical properties of uranium are summarized and presented in graphic and tabular form. (T.R.H.)

Waste Disposal

190 CF-55-10-101
Oak Ridge National Lab., Tenn.
RADIOACTIVE WASTE ECONOMICS: OPTIMUM STORAGE TIME PRIOR TO SHIPPING TO DISPOSAL SITE. H. R. Zeitlin and J. W. Ullmann. Oct. 24, 1955. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The economics of waste disposal by pit storage when the geological location of the pits does not coincide with the location of the processing plant are considered. Optimum cooling times before shipment were determined for 250-gallon batches of Purex-type waste. Three distances between processing and disposal sites, and three unit storage costs were considered. It was concluded that as the storage cost increases it becomes economical to ship shorter-cooled waste, and as the shipping distance increases, it becomes economical to store waste longer. In the case of $0.30/gal/yr storage, for 200 miles shipment, essentially no storage should be provided beyond that required for surge in filling carriers. For less highly irradiated material, the optima would shift in the direction of shorter cooling times. Data are tabulated and presented graphically. (C.H.)

191 HW-52055
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EFFECT OF DETERGENTS UPON ABSORPTION OF RADIOISOTOPES BY SOILS. K. C. Knoll. Aug. 1, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

Twelve detergents were tested to determine their effect upon the absorption of Sr^{90}, Cs^{137}, and Pu^{239} by soils. Each detergent was tested at four different values of pH. Results are given which compare the distribution coefficients of these isotopes between the detergent solution and the soil and between water and soil. No generalized statement can be made about the effect of the detergents. Each detergent at any hydrogen ion concentration must be considered individually. (auth)

ENGINEERING

192 AERE-R/R-2271
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
INSULATED LEAD-THROUGH SEALS FOR USE AT HIGH TEMPERATURES. F. Wade. May 1957. 7p.

The seals were made from a variety of materials, i.e., quartz, ceramics, and artificial sapphire. All of these materials were brazed to suitable metals with a Ti cored Cu–Ag eutectic alloy. Quartz-metal seals of the type described should not be operated at temperatures above 150°C on account of the sharp increase in the coefficient of expansion of 36% Ni/Fe at this point. (auth)

193 NP-6448
California. Univ., Berkeley. Minerals Research Lab.
A SURVEY OF RECENT RESULTS ON EXPERIMENTAL DETERMINATIONS OF ACTIVATION ENERGIES FOR CREEP. Technical Report No. 3. John E. Dorn. Aug. 1, 1957. 37p. Contract Nonr-222-(49).

A review of a few results that have already been published and a brief survey of more recent and as yet unpublished data on activation energies for creep are presented. (W.L.H.)

194 NP-6454
Shell Development Co., Emeryville, Calif.
ENGINE OIL DEVELOPMENT. Quarterly Progress Re-

port No. 7 [for] May 1 through July 31, 1957. C. L. Mahoney, K. J. Sax, W. W. Kerlin, and E. R. Barnum. 47p. Project 7-(1-125A). Contract AF33(616)-3182. (S-13734).

Of all materials investigated for use as radiation-resistant high-temperature lubricants, selected polyphenyl ether derivatives continue to show the most promise. Other highly-aromatic compounds are equally as stable to radiation, oxidation and thermal decomposition but their lubrication characteristics are comparatively poor. Physical properties, e.g., melting point, volatility and flash point of the polyphenyl ethers are also superior to those of the corresponding polyphenyls. Physical properties of various materials were measured over a wide temperature range. Radiation levels and temperatures of several performance tests have also been made more severe in order to establish the limitations of various potential high-temperature oils. Several new compounds were synthesized and evaluated. Although none of them were superior, under high temperature conditions, to previously reported polyphenyl ethers, some of them displayed improved low-temperature properties and hence merit further investigation. (auth)

195 WADC-TR-57-61(Pt. I)
Clevite Research Center, Cleveland.
LUBRICATION OF TITANIUM. Period Covered: March 14, 1956 to February 14, 1957. Richard O. Lee and Nicholas Fatica. Feb. 1957. 54p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF-33(616)-3350.
(For preceding period see NP-6320.) (T.R.H.)

196 WAPD-BT-3
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. VOLUME I, NO. 3. REACTOR CHEMISTRY AND PLANT MATERIALS. Aug. 1957. 145p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. $4.00(OTS).

Corrosion Studies. Results of an extensive investigation of chloride stress corrosion testing of type 347 stainless steel steam generator tubing are presented. Experiments to determine the effect of corrosion on type 304 stainless steel with varying carbon content in reference primary coolant water are given. Van de Graaff studies were undertaken to determine what variables are involved in the phenomenon of preferential deposition of crud on fuel element surfaces. Calculated deposited crud activity in the Shippingport Pressurized Water Reactor primary system due to corrosion of core materials is given. An investigation of corrosion and crud deposition of Zircaloy surfaces under nucleate boiling is given. Decontamination. Methods of decontamination of structural materials and surface coatings for use in nuclear installations are given. Analytical Instrumentation. The theory behind the design of a system for locating and detecting fuel element failure is presented. Materials Application. A brief summary is presented of the present status of development work intended to enable the substitution of ordinary carbon steel for stainless steel in primary and purification systems of pressurized water reactors. As a result of a fabrication development program a Zircaloy-2 tube was built to facilitate in-pile testing of reactor fuel elements. Mechanical properties of Co–Cr alloy bearing materials in compression at elevated temperatures are presented. Welding and Brazing. A standard seal weld machine is described which was designed to seal-weld all mechanisms, fuel ports, and instrument ports of a single reactor. (W.L.H.)

197
VENTILATION PROBLEMS AND THEIR SOLUTIONS. Walter S. Shurkin (National Lead Co. of Ohio, Cincinnati). Chem. Eng. Progr. 52, Symposium Ser. No. 19, 61-5 (1956).

The ventilation problems found at the field-materials-production center operated by National Lead Co. of Ohio are summarized. Discussions are included on dust collectors, make-up air at the laboratory, perchloric acid hazard, pneumatic conveying, dumping and packaging, and the refining process. (M.H.R.)

198
JOINTS FOR USE IN PIPELINES AND BETWEEN PARTS OF VESSELS. J. P. A. Macdonald (to Crane Packing Ltd.). British Patent 773,541. Nuclear Eng. 2, 408(1957) Sept.

The one-piece jointing element for corrosive, noxious or toxic fluids is formed from a ring with a deep internal slot affording a certain flexibility in the direction of its thickness although of normally non-resilient material. Continuous serrations or corrugations are provided on the opposite faces of the ring to fit into recesses formed in the opposing ends of the pipelines or vessel parts between which the ring is clamped. (auth)

Heat Transfer and Fluid Flow

199 AERE-R/R-2357
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A RATIONAL BASIS FOR THE DESIGN OF BAYONET-TUBE HEAT EXCHANGERS. J. J. Thompson and R. W. S. Carlson. Aug. 1957. 16p. (LMFS/P-13).

The theory of bayonet-tube heat exchangers is presented, and an example illustrating the design of a bayonet-tube heat exchanger for a circulating fuel reactor system is given. (T.R.H.)

200 CF-56-9-132
Oak Ridge National Lab., Tenn.
HEAT TRANSFER TO BINGHAM PLASTICS, ThO_2 SLURRIES FLOWING TURBULENTLY IN TUBES: AN EXPLORATORY STUDY. C. G. Lawson. Sept. 30, 1956. 27p. $4.80(ph OTS); $2.70(mf OTS).

A heat transfer equation was derived relating the fluid friction to the heat transfer coefficient for Bingham plastic slurries. (W.L.H.)

201 IGRL-T/W-40
AN INVESTIGATION INTO THE INFLUENCE OF SPEED OF CIRCULATION ON THE VALUES OF CRITICAL HEAT FLOWS FOR LIQUID BOILING IN TUBES. L. S. Sterman and N. G. Styushin. Translated by E. G. Peters from Zhur. Tekh. Fiz. 22, 446-54(1952). 11p.

The results of investigations into the determination of the dependence of critical heat flow Q_{cr} and heat flow Q_{min}, at which the change from film to nucleate boiling takes place, on speed of circulation are presented. The investigation was carried out with isopropyl spirit. This liquid was chosen because the values of critical heat flow for isopropyl spirit are comparatively small, and therefore it could be expected that the range of speeds which could be obtained on the existing experimental installation (up to 6-7 m/sec) would prove sufficient for the determination of the rule governing the variation of Q_{cr} and Q_{min} according to W_o. All the experiments were carried out on a tube with an internal diameter of 16 mm made from E YA-1 T stainless steel. The length of the experimental part of the tube was 100 mm, and the length of the stabilizing section of tube before the experimental part was about 500 mm. The heating of the experimental tube was carried out by low tension direct current supplied from a motor generator. (auth)

202 KAPL-M-RES-42

Knolls Atomic Power Lab., Schenectady, N. Y.

THERMAL NETWORKS. ELECTRICAL ANALOGIES FOR THERMAL CIRCUITS IN NUCLEAR REACTORS. H. F. Larkin. July 22, 1957. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A number of electrical analogs for steady-state thermal circuits are presented which can be used in nuclear reactor design. A complicated control drive mechanism thermal barrier design is presented in network form to show how this approach can help to systematize and simplify an analysis. A possible configuration for a control drive mechanism thermal barrier is presented. In some designs heat is transferred mainly by means of natural convection. In other designs (usually the better ones) conduction and convection are both important. In cases where both are important, a detailed and systematic approach is required in order to assure reasonable estimates of the heat load. The thermal circuit presented, though not exact, enables the design engineer to make a reasonable estimate of both the heat load and the temperature distribution which may be required for stress analysis. (auth)

203 NP-6446

Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.

THE CORRELATION OF NUCLEATE BOILING BURNOUT DATA. Technical Report No. 9. Peter Griffith. Mar. 1957. 20p. D.I.C. Project Nos. 5-7348 and 5-7374. Contract N5ori-07827.

A dimensionless correlation is developed for nucleate boiling burnout data including the following ranges of variables: for water, benzene, n-heptane, n-pentane, and ethanol, at pressure-0.0045 to 0.96 of critical pressure, velocity-0 to 110 ft/sec, subcooling-0 to 280°F, and quality-0 to 70%. The data are drawn from a variety of sources and have been collected on widely varying types of systems. Over 300 points are correlated with 94% of the points included between the ±33% envelope drawn around the best line through the points. The correlation includes only fluid properties and quantities which can be calculated on the assumption of equilibrium conditions at the burnout point. (auth)

204

NUSSELT VALUES FOR ESTIMATING TURBULENT LIQUID METAL HEAT TRANSFER IN NONCIRCULAR DUCTS. James P. Hartnett and Thomas F. Irvine, Jr. (Univ. of Minnesota, Minneapolis). A.I.Ch.E. Journal 3, 313-17 (1957) Sept.

A simple expression for estimating the turbulent forced-convection heat transfer performance of liquid metals flowing through noncircular ducts is presented. This equation requires the knowledge of the slug Nusselt number evaluated for the specific geometry and for the pertinent boundary conditions. Such Nusselt values are presented for a number of technically important geometries. One check on the heat transfer prediction is in the case of an annular duct with constant heat flow through the outer wall with the inner wall insulated, for which experimental data exist. The prediction agrees within 20% with the experimental data. Several possible boundary conditions that may exist in noncircular cross sections are thoroughly discussed, and it is hoped that as a result this paper may serve to clarify some of the confusion existing in the literature. (auth)

205

THE CASE FOR FORCED DRAUGHT COOLING TOWERS. Derek J. Tow (Wrightson Processes, Ltd.). Nuclear Power 2, 366(1957) Sept.

206

HEAT-TRANSFER AND FLOW-FRICTION CHARACTERISTICS OF WOVEN-SCREEN AND CROSSED-ROD MATRIXES. L. S. Tong (Westinghouse Electric Corp., Pittsburgh) and A. L. London (Stanford Univ., Calif.). Trans. Am. Soc. Mech. Eng. 79, 1558-70(1957) Oct.

Woven-screen or crossed-rod types of matrixes may be of interest as fuel-element geometries for certain types of nuclear reactors as well as in many other heat-transfer and mass-transfer systems. Basic heat-transfer and flow-friction design data for these geometries are presented graphically, in nondimensional form, for a range of Reynolds numbers from 5 to 100,000 and matrix porosities from 0.60 to 0.83. Algebraic equations which adequately represent these data are also given and these may be used for interpolation and, at least tentatively, for a limited extrapolation beyond the range of porosities covered in this program. (auth)

Materials Testing

207 BMI-1216

Battelle Memorial Inst., Columbus, Ohio.

THE TORQUE AND WEAR CHARACTERISTICS OF WATER-LUBRICATED BALL BEARINGS. William H. Goldthwaite, David W. Knoll, and C. Malcolm Allen. Aug. 22, 1957. 43p. For [Westinghouse Electric Corp.,] Bettis Plant. Contract NObs-67500, Subcontract 73-(04-750).

A research program evaluating the torque and wear characteristics of water-lubricated ball bearings as a function of certain design parameters was conducted. Ball-to-race conformity, contact angle, degree of alignment, and contact stress were the independent variables selected for this study. Size 209 ball bearings with Stellite 19 races, Stellite 3 balls, and 17-4 PH stainless steel retainers were operated under pure thrust loads in high-purity oxygenated water at 30 rpm for 250,000 cycles. The torque-measuring system of the experimental apparatus was designed to provide linear-amplitude response to transient torques down to a 0.02-sec duration. Continuous torque records were obtained and analyzed for each bearing design and set of operating conditions. Weight-loss and dimensional changes were measured to determine wear. The data were analyzed by several statistical methods to determine the effect of the chosen variables on torque and wear. These analyses uncovered significant effects from ball-to-race conformity and contact stress and a high random variation caused presumably by variables outside the scope of this study which overshadowed any minor effects of the chosen variables. However, a relatively strong correlation of torque and wear with load (normal ball load) was obtained. Metallographic studies and visual examinations indicated that the bearing materials may have contributed significantly to the scatter in the results because of variations in cast structure and density. (auth)

208 KAPL-M-HFK-6

Knolls Atomic Power Lab., Schenectady, N. Y.

OPERATION WITH LEAKS (OWL) TEST PROGRAM. Final Report. H. F. Karnes. Sept. 25, 1956. 41p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

The program included a series of studies designed to evaluate the possibility of operating a Na-cooled power plant after failure of one wall of a double-walled evaporator. Particular emphasis was placed on operation of an evaporator using NaK as a third fluid, after failure of the NaK-boiling water heat transfer surface. The consequences to a Na system of a double-tube failure were also studied. (W.L.H.)

209 NP-6438

Grumman Aircraft Engineering Corp., Bethpage, N. Y.

SEAPLANE HULL BOTTOM NEUTRON ACTIVATION

STUDY. Bi-monthly Progress Report No. 1. L. B. Wehle, Jr., and A. F. Sutton. June 1957. 12p. Contract NOas-57-622. (RE-86-PR-1).

The work done in this study of fast neutron activation of amphibian hull bottom materials has so far been of a preparatory nature. Since the Brookhaven reactor will be used for specimen irradiation, it has been necessary to make calculations to determine and to improve on the flux spectrum obtainable in this facility. Mechanical equipment that will be simple and safe to operate, and will ensure the efficient use of the reactor has been designed for incorporation into the instrument tunnel. In anticipation of a large volume of experimental observations, methods have been devised for rapid analysis of activation data on digital computers. (auth)

210

ATOMIC ENERGY IN QUALITY CONTROL OF HERMETICALLY SEALED PARTS. Clifton W. Reed (Reed-Curtis Nuclear Industries, Culver City, Calif.). Non-Destructive Testing 15, 266-8(1957) Sept.-Oct.

A method is presented for mass nondestructive testing of small hermetically sealed parts. This leak inspection test is called the Radiflo test. The method involves the use of large tanks to contain quantities of the parts to be tested. The tanks are sealed and radioactive gas is applied to the interior of the tank under pressure. A period of time is allowed to permit leakage of the radioactive molecules into the interior of any part. The parts are removed and placed in front of a radiation detector, and the amount of leakage into the parts is determined. (W.L.H.)

211

THE USE OF GAMMA RADIATION FOR DENSITY MEASMENT. Philip E. Ohmart (Ohmart Corp., Cincinnati, Ohio). Non-Destructive Testing 15, 270-3(1957) Sept.-Oct.

A gamma density gage for the measurement of the level of liquids and slurries, the position of liquid-liquid and liquid-slurry interfaces, specific gravity of liquids, and the density or per cent solids of slurries is presented. (W.L.H.)

Pumps

212 AERE-R/M-95

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DESIGN AND DEVELOPMENT OF A LIQUID METAL MECHANICAL PUMP. F. L. Speed and K. A. Tomblin. Sept. 1953. 16p.

Mechanical pumps for use on liquid metal work can be broadly classified into the following types: totally enclosed pump employing internal bearings operating in liquid metal and driven by some form of magnetic coupling and, conventional pump with external oil lubricated bearings overhung impeller and a shaft seal unit. It was agreed that the former type of mechanical pump was a more attractive solution for large scale plant. However, as considerable development work both on bearings operating in liquid metal and the method of drive was required, it was decided to design a pump of the latter type which appeared to offer a quick solution for laboratory use. A description of the work carried out in developing such a pump for a particular laboratory application is presented. (auth)

213 AERE-R/R-2274

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TESTS ON AN EXPERIMENTAL D.C. PUMP FOR LIQUID METALS. D. A. Watt, R. J. O'Connor, and E. Holland. May 1957. 52p.

The experimental equipment and techniques of construction and measurement are briefly described. A comprehensive survey of pump performance with graded field to control end current losses is given, together with some results for a simple baffle system. Field grading gives the better result, the maximum efficiency being near 40% with Hg in an 18/8 stainless steel channel with 25 gpm flow. It is considered that a baffle system of improved form may have some advantage in pumps of smaller length/width ratio. For the pump described this ratio, $c/b = \frac{7}{3}$. Gas entrainment tests are described; these showed only small changes in pump performance. Hydraulic friction losses deduced from water flow tests are recorded. (auth)

214 CF-57-9-55

Oak Ridge National Lab., Tenn.

STRESSES AND DEFLECTIONS INDUCED IN SEAL-WELDING A DIAPHRAGM PUMP. E. C. Hise. Sept. 18, 1957. 10p. $1.80(ph OTS); $1.80(mf OTS).

Results indicate that diaphragms can be seal-welded without damage. The diaphragms are not dished in the heads, in fact, the seal welding may tend to straighten out any irregularities that exist in the diaphragm. The stresses introduced by seal weldings are small and in the case of the purge pump do not exceed 2000 psi; in fact, the seal welding appears to relieve the stresses introduced by clamping flat the previously irregular sheet metal diaphragm. (auth)

215 CF-57-10-48

Oak Ridge National Lab., Tenn.

INVESTIGATION OF EFFECT OF SEAL CONFIGURATION ON MIXING FLOW AND RADIATION DAMAGE IN HRT-TYPE CIRCULATING PUMPS. H. A. Rundell, D. H. Roy, and J. C. Moyers. Oct. 10, 1957. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Tests using a Westinghouse 400A canned motor circulating pump with various motor to impeller seal configurations are described. A configuration was found which allows very low flow rates and increases pump life. (T.R.H.)

Waste Disposal

216 CF-57-8-118

Oak Ridge National Lab., Tenn.

RADIOACTIVE WASTE TREATMENT AND DISPOSAL—A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. D. L. Africk, P. E. Novak, and J. O. Blomeke. Oct. 3, 1957. 33p. $6.30(ph OTS); $3.00(mf OTS).

This bibliography of the unclassified literature on radioactive waste treatment and disposal was compiled from references published in the Nuclear Science Abstracts, Volume 4, No. 1 (January 15, 1950) through Volume 11, No. 10 (May 31, 1957). The 304 references have been categorized as to subject matter, and brief abstracts have been included where needed to show pertinent information not indicated by either the document title or category. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

217

HANDLING AND USES OF THE ALKALI METALS. ADVANCES IN CHEMISTRY SERIES 19. Washington, American Chemical Society, 1957. 181p. $4.75.

The production, recovery, uses, and handling of K, Na, and Li are described and discussed. Papers are included

on: alkali metal polymerization catalysts, recleaning Na heat transfer systems, corrosion resistance of metals and alloys to Na and Li, manufacture, uses and handling of NaH, Na_2O_2 production, preparation and use of NaO_2, uses of Na in metallurgy, reactions of Na with organic compounds, determination of NaO in Na, and manufacture of K and Na–K alloys. (T.R.H.)

Ceramics and Refractories

218 AD-56939
North Carolina State Coll., Raleigh.
VIBRATORY COMPACTING OF METAL AND CERAMIC POWDERS. Quarterly Report No. 10 [for] October 1, 1954 to January 1, 1955. William C. Bell and John R. Hart. 27p. Project No. 7350. Contract AF33(616)-73.

Compositions containing 70 Al_2O_3–30 Cr were sintered in both purified H_2 and under relatively high vacuum conditions. The use of the relatively high vacuum conditions appears much more promising than the use of the H_2 atmosphere. The properties of the composition sintered under the two conditions have been tabulated for comparative purposes. Additional work has also been done on the sintering of the 85 Ti–15 Ni compositions under relatively high vacuum conditions. Evaporation at the maximum temperature offers quite a problem with these compositions since weight losses of up to 10% were noted. Specimens sintered in this manner, however, were found to have high density and strength values. Specimens were prepared from alumina compositions in a wide variety of particle sizes for use in thermal shock and impact strength tests. Preliminary thermal shock and impact strength tests were made on specimens of the various compositions. Several different types of thermal shock tests procedures were studied but a completely satisfactory test was not developed. (auth)

219 AD-65675
North Carolina State Coll., Raleigh.
VIBRATORY COMPACTING OF METAL AND CERAMIC POWDERS. Quarterly Report No. 11 [for] January 2, 1955 to April 2, 1955. William C. Bell and John R. Hart. 13p. Project No. 7350. Contract AF33(616)-73.

Additional particle size distribution studies have been made. Although high densities and low porosities were obtained for the coarse-containing compositions, even 10% additions of 100-mesh materials detrimentally affected the flexural strength of both the Cr–Al_2O_3 and Ni–WC cermets. Variations in ball milling time were found to affect the properties of the cermets, but if the ball milling times were held to reasonable limits this affect appeared to be relatively small. Considerable work has been done on the use of the vibratory compaction process for the forming of intricate and unbalanced shapes. The vibratory forming method appears to offer definite advantages over dry pressing for this type of operation. The use of hydro static repressing after vibratory forming was studied, but the use of high pressure repressing did not materially improve the properties of the specimens. The use of paraffin as a lubricant and binder to replace the water formerly used for forming the carbide composition was investigated. Although suitable forming techniques were developed, no advantage has been noted in the substitution. (For preceding period see AD-56939.) (auth)

220 BMI-1223
Battelle Memorial Inst., Columbus, Ohio.
PROPERTIES OF SOME REFRACTORY URANIUM COMPOUNDS. M. Jack Snyder and Winston H. Duckworth. Sept. 9, 1957. 35p. Contract W-7405-eng-92. $1.00(OTS).

Methods of preparing some refractory uranium compounds and of sintering them to high densities are described. Thermal-expansion coefficients, specific heats, microhardnesses, and rates of reaction with oxygen and nitrogen are given for the silicides and UAl_2. The thermal-expansion coefficients of the silicides and of UAl_2 were approximately equal and of the same order of magnitude as that of uranium metal. Specific heats ranged from about 0.04 cal/(g)(C) for U_3Si to about 0.08 cal/(g)(C) for USi_3. The microhardness of USi_3 was appreciably lower than that of the other silicides. The initial oxidation of USi_2, USi_3, U_3Si_2, and UAl_2 at 150 to about 400°C resulted in the formation of a protective film. In contrast, nonprotective oxide films were formed on uranium and USi at these temperatures. A protective film was formed in the reaction of all the silicides with nitrogen at temperatures of about 400 to 700°C, but reaction rates were higher than that of nitrogen with uranium. (auth)

221 CWR-481
Curtiss-Wright Corp. Research Div., Quehanna, Penna.
REPRODUCIBILITY OF THE MECHANICAL PROPERTIES OF CERAMIC MATERIALS. PART II. THERMAL SHOCK RESISTANCE OF HIGH PURITY ALUMINA SPECIMENS. N. R. Wheelock and C. A. Liedholm. Aug. 19, 1957. 16p. Contract AT(30-3)-220. $3.30(ph OTS); $2.40(mf OTS).

This report is the second in a series concerning the reproducibility of the properties of ceramic materials. Previous work, reported in CWR-456 (Ref. 1) concluded that the modulus of rupture of a batch of high purity alumina specimens was in statistical control, making it possible to estimate the probability of failure associated with any arbitrarily selected load. The present report concerns the thermal shock strength of specimens of a similar material. The experimental data obtained agreed well with the assumption that thermal shock strength also was in statistical control, so that the probability of failure could be estimated for cooling in still air from any arbitrarily selected uniform heating temperature. (auth)

222 NACA-TN-3927
Lewis Flight Propulsion Lab., Cleveland.
PRELIMINARY INVESTIGATION OF THE EFFECT OF SURFACE TREATMENT ON THE STRENGTH OF A TITANIUM CARBIDE–30 PERCENT NICKEL BASE CERMET. Leonard Robins and Edward M. Grala. Dec. 11, 1956. 16p.

The effect of various surface treatments on the room-temperature modulus of rupture and impact strength of a nickel-bonded titanium carbide cermet was investigated. The average strengths for the treatments varied from about 200,000 to 80,000 $lb/in.^2$ in modulus of rupture, and about 3.5 to 1 in.-lb in impact resistance. The strengths of lapped, grit-blasted, diamond-ground, or vapor-blasted specimens were not significantly different. The most serious losses of strength occurred after oxidation (at 1600°F for 100 hr), surface roughening by acid attack, and severe grinding with a 60-grit silicon carbide abrasive wheel. The modulus-of-rupture strength of oxidized specimens was improved after grit blasting or regrinding with a diamond abrasive wheel. The magnitude of the changes in impact and modulus-of-rupture strengths for some surface treatments were quite different. (auth)

Corrosion

223 AECD-4248
[Los Alamos Scientific Lab., N. Mex.].
CORROSION STUDIES. John R. Phillips. [1957]. Decl. Sept. 13, 1957. 13p. Contract [W-7405-eng-36]. $3.30 (ph OTS); $2.40(mf OTS).

The first in this series of runs in testing materials was done in a solution of 0.5M UO_3 in 15.4M (85%) H_3PO_4. Materials tested were 316 ELC, 321, and 347 stainless steels and Hastelloy C. A second series of runs were made on 316 ELC stainless steel, Ti, Ta, and Nb in 0.410M UO_3 in 7.14M H_3PO_4. A third series of tests were conducted on 316 ELC and 347 stainless steels and Pt in 0.483M UO_3 in 4.10M H_3PO_4. (J.E.D.)

224 AECU-3561

Kentucky. Univ., Lexington. Kentuck Research Foundation.

SCALING OF ZIRCONIUM AND ZIRCONIUM ALLOYS. Technical Progress Report No. 1. J. A. Burka, C. S. Crouse, and R. E. Swift. Aug. 1957. 46p. Contract AT(33-3)-1. $1.25(OTS).

Zirconium-base binary alloys were prepared using the elements Mo, Fe, Co, Cr, Ni, Cu, Ag, Ta, Nb, Pt, Pa, Os, Ir, Rh, Ru, V, Si, Mn, Sn, Pb, W, Sb, Ge, Al, Ti, Mg, Zn, La, and Ba. Also, Zr-base ternary alloys were prepared using the elements Cu, Ni, Nb, Ta, V, Sn, Sb, and W. The maximum total alloy content of the alloys was five per cent. The Zr used was low-Hf sponge,and the alloys were prepared by arc melting in an Ar atmosphere. The alloys were tested for scaling resistance at the temperatures 1200, 1500, and 1800°F in a multi-specimen furnace for periods up to about 300 hours. Scaling propensity of the alloys was evaluated on the basis of the weight increase per unit area as compared to that of unalloyed Zr. The binary alloys containing Ni and Cu showed the greatest scaling resistance of all the binary alloys at all temperatures. Ternary alloys showed little or no improvement over the most scaling resistant binary alloys. The number of alloys more resistant than unalloyed Zr was about the same at 1200 and 1500°F, but was considerably more at 1800°F. In general, there was some change in the order of relative scaling propensity based on the average weight increase per average unit area per hour at the three temperatures. A logarithmic plot of weight increase versus time for most of the alloys showed a sharp increase in the scaling rate after various periods of time, whereas very few showed a decrease. (auth)

225 AERE-M/M-96

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FAILURE OF THE SODIUM/STEAM HEAT EXCHANGER IN THE LIQUID METAL STEAM PLANT OPERATED BY MESSRS. FOSTER-WHEELER. A. Stephenson. Dec. 21, 1955. 12p.

Two tube plates from the Liquid Metal Steam Plant at Foster Wheelers have been examined to investigate the origin of the sodium-steam heat exchanger failure after 348 hours. One stainless steel tube plate showed extensive transcrystalline cracking; cracks were also found in the stainless steel tubes expanded into this tube plate and in the sodium end box adjacent to the tube plate. Less extensive cracking was found in the upper tube plate and adjacent parts of the tube. Though direct proof has not been obtained the failure is attributed to stress corrosion cracking arising from the concentration of chloride solutions on the steam side in the crevices between the tubes and the failed tube plate. After perforation from the steam side the damage may have been accentuated by NaOH solution attack if on reduction of the steam pressure on shutting down, sodium penetrated to the steam side. Further features include severe pitting of the bores of the expanded ends of the tubes and an intergranular network found on the bores of parts of the tubes to a depth of approximately 0.003 inch. These features were only found in places where the steel had been severely cold-worked. Suggestions are made for possible modifications to the design, manufacture and operation to reduce the risk of similar failures and for further metallographic work when the plant is finally shut down. (auth)

226 AERE-M/TN-34

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A REVIEW OF THE CORROSION OF SOME POSSIBLE MATERIALS FOR HIGH TEMPERATURE WATER REACTORS. J. N. Wanklyn. July 1955. 34p. (LEO/RDC-38).

The literature of the corrosion of stainless steel, mild steel, Zr, and Al in high temperature water is reviewed. The use of these metals in water-cooled reactors is considered in the light of the information presented. (auth)

227 ANL-5783

Argonne National Lab., Lemont, Ill.

CORROSION OF AN ALUMINUM–NICKEL ALLOY IN A REACTOR TEST LOOP. Emil Louis Martinec. Sept. 1957. 18p. Contract W-31-109-eng-38. $0.75(OTS).

The results of the corrosion study are illustrated in a plot of the weight loss of the aluminum–nickel samples with respect to the time at test temperatures of 470 to 485°F. The corrosion rate determined by this test indicates that the weight loss per unit time is the same for both the in-pile irradiated specimens and the out-of-pile control specimens which did not have any neutron exposure, except that the out-of-pile specimens had a higher initial rate of corrosion which elevated the curve above that of the in-pile specimens. (auth)

228 CF-57-7-121

Oak Ridge National Lab., Tenn.

SOLUTION CORROSION GROUP QUARTERLY REPORT FOR THE PERIOD ENDING JULY 31, 1957. J. C. Griess, H. C. Savage, J. L. English, R. S. Greeley, W. C. Ulrich, S. R. Buxton, P. D. Neumann, D. N. Hess, and T. H. Mauney. July 31, 1957. 64p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

The second All-Ti loop, 100A loop H, was placed in operation for more than 400 hr with UO_2SO_4 solution at 250°C and ~1000 psi. A fourth test of the mockup of the Zircaloy-2–stainless steel transition joint used in the HRT reactor vessel was completed. The joint and bellows functioned properly and were leaktight. The series of long-term runs at 200, 250, and 300°C with solution proposed for use in the HRT was concluded. Stainless steel and Ti stress specimens exposed during the latter 13,000 hr of these tests gave no evidence of stress-corrosion cracking. Results of a study of the effect of heat treatment on corrosion of type 347 stainless steel are presented. Pretreatment of stainless steel for 100 hr at 250°C with oxygenated H_2O containing 100 or 200 ppm Cr^{6+} as CrO_3 decreased initial weight losses on subsequent exposures to UO_2SO_4 solutions. Stress-corrosion cracking of stainless steel in UO_2SO_4 solutions is described. A number of alloys of Zr were corrosion tested in simulated HRT core solutions at 300°C. Type 347 stainless steel, surface hardened either by malcomizing or Thermospray 16-C, corroded excessively in UO_2SO_4 solutions. Hastelloy R-235, Multimet, and Timken 16-25-6 demonstrated a high degree of corrosion resistance to simulated core solution at 300°C. Under the same conditions types 431 and 414 stainless steel corroded excessively. Type 420 stainless steel hardened at 50 to 52 Rockwell C corroded badly in 90°C UO_2SO_4 solution of the composition used in in-pile loops. (W.L.H.)

229 CF-57-8-41

Oak Ridge National Lab., Tenn.

HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-4-13. F. J. Walter. Aug. 23, 1957. 17p. $3.30(ph OTS); $2.40(mf OTS).

230 CF-57-8-42
Oak Ridge National Lab., Tenn.
HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-2-15. F. J. Walter. Aug. 27, 1957. 22p. $4.80(ph OTS); $2.70(mf OTS).

231 CF-57-8-43
Oak Ridge National Lab., Tenn.
HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-2-14. F. J. Walter. Aug. 28, 1957. 17p. $3.30(ph OTS); $2.40(mf OTS).

232 CF-57-8-111
Oak Ridge National Lab., Tenn.
HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-4-16. F. J. Walter. Aug. 26, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

233 CF-57-8-112
Oak Ridge National Lab., Tenn.
HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-2-17. F. J. Walter. Aug. 30, 1957. 24p. $4.80(ph OTS); $2.70(mf OTS).

234 CF-57-8-113
Oak Ridge National Lab., Tenn.
HRP IN-PILE CORROSION TEST LOOPS, OPERATION OF IN-PILE LOOP L-4-18. F. J. Walter. Aug. 30, 1957. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

235 CF-57-10-6
Oak Ridge National Lab., Tenn.
LITHIUM SYMPOSIUM — ANALYTICAL PROCEDURES AND HIGH-TEMPERATURE CORROSION. Reading List. E. E. Hoffman and D. H. Jansen. Oct. 1, 1957. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A list of 199 references pertaining to corrosion by molten lithium and related subjects has been compiled in connection with a Lithium Symposium held at the Oak Ridge National Laboratory on August 7-8, 1957. This list is by no means exhaustive, but it is thought to contain most of the information presently available on these subjects. In many cases the individual references contain additional references. (auth)

236 HW-32877
Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF CHROMIUM IN NITRIC ACID SOLUTION ON THE CORROSION RESISTANCE OF TYPES 304L AND 309SCb STAINLESS STEEL. Kenneth L. Sanborn. Aug. 31, 1954. Changed from OFFICIAL USE ONLY Jan. 28, 1957. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The corrosive effects of Cr^{3+} and Cr^{6+} in HNO_3 solutions of various concentrations on types 304L and 309SCb austenitic stainless steel are presented. (W.L.H.)

237 HW-37642
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FIELD CORROSION TESTS IN REDOX AND PUREX UNDERGROUND WASTE STORAGE TANKS. Norman D. Groves, Morris C. Fraser, and William L. Walker. June 28, 1955. Changed from OFFICIAL USE ONLY Mar. 22, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A corrosion-testing program has been initiated in Purex and Redox storage tanks to obtain corrosion data on carbon steel and three associated materials in neutralized process wastes. (C.W.H.)

238 HW-49431
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CORROSION OF ALUMINUM IN DEIONIZED WATER. Progress Report [for] January 1957–April 1957. R. L. Dillon and R. J. Lobsinger. Mar. 26, 1957. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Static and dynamic tests were made to determine the effects of flow, hydrogen ion concentration, common ion effect, and inhibitors on corrosion rates of Al alloys. Autoclave studies were designed to determine rates and mechanism of corrosion. (J.E.D.)

239 HW-50133
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
UNIFORM AQUEOUS CORROSION OF ALUMINUM — EFFECTS OF VARIOUS IONS. V. H. Troutner. June 10, 1957. 60p. Contract W-31-109-Eng-52. $1.75(OTS).

The most important variable in water quality on the uniform corrosion of Al was the pH. Solutions of distilled water containing phosphate ions and citrate ions were the only media which showed a definite specific ion effect. Phosphate inhibited the corrosion and citrate increased it. Oxalate ions appeared to increase corrosion, but the effect is not definitely demonstrated by the data. Corrosion was dependent only on pH in tap water, reactor process water, distilled water, and distilled water containing up to 100 ppm of chloride, nitrate, sulfate, bicarbonate, hydrogen peroxide, acetate, arsenate, silicate, dichromate, molybdate, and mixtures of these ions. Solutions of up to 10,000 ppm chloride in distilled water showed no specific ion effect upon uniform Al corrosion. The effects of 0 to 10 ppm of dichromate and phosphate ions were investigated over the range pH 4 to pH 7. Phosphate at 10 ppm inhibited corrosion in solutions containing up to 2 ppm of dichromate, but at 10 ppm dichromate the phosphate does not appear to inhibit corrosion. Also at 10 ppm dichromate, the effect of pH is diminished over the range pH 4 to pH 7. Corrosion rates varied with the flow rates of the test solutions at low flow rates, and were lowest at the lowest flow rates. This effect was attributed to the buildup of aluminate ion concconcentration in the lower flow systems. Short term corrosion tests at 92°C revealed major specific ion effects. Minor effects were lost in experimental uncertainties. The inhibiting effect of phosphate under these conditions has been shown to exist over longer exposures at higher temperatures. (auth)

240 HW-52008
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CORROSION OF ALUMINUM IN DEIONIZED WATER. Progress Report [for] April 1957–September 1957. R. J. Lobsinger and R. L. Dillon. Aug. 28, 1957. 12p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

241 NMI-1190
Nuclear Metals, Inc., Cambridge, Mass.
CORROSION OF BERYLLIUM IN 600°F WATER. D. S. Kneppel. Sept. 10, 1957. 21p. Contract AT(30-1)-1565. $0.75(OTS).

In a study of certain variables affecting the corrosion resistance of Be in 600°F water, the metal had a maximum life of 140 to 160 days before accelerated local attack. Of the various fabrication procedures studied, only quenching from about 1750°F gave any indication of improving corrosion resistance. Among the alloys tried, 0.66 wt. % Ni gave similar promise; one such sample accumulated 280 days' exposure to 600°F water, without signs of failure. (auth)

242 NP-6443
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEVELOPMENT OF HIGH TEMPERATURE OXIDATION-CORROSION INHIBITORS TO IMPROVE STABILITY OF

HIGH TEMPERATURE HYDRAULIC FLUIDS AND LUBRICANTS. Quarterly Progress Report No. 1 [for] March, April, and May 1957. Robert Brunier and Edward J. Schwoegler. Sept. 18, 1957. 18p. ARF Project C 103. Contract AF33(616)-5101.

Data were collected on known corrosion inhibitors for synthetic diester fluids, mineral oils, and silicone and silane fluids and analyzed for indications as to structural configurations and functional groups contributing to the inhibitory effect. A synthesis program for inhibitors for synthetic diester fluids and silicones is described. (T.R.H.)

243 AERE-Lib/Trans-747

THE MECHANISM OF CORROSION CRACKING OF AUSTENITIC STEELS. A. V. Ryabchenkov and V. M. Nikiforova. Translated by J. Adam from Metalloved. 8, 2-11(1956). 16p.

The aim of this work was to establish the role of electrochemical factors in the process of corrosion cracking of highly alloyed austenitic steels and to study the influence on these steels of static tensile stresses and corroding media, i.e., electrolyte solution. It is concluded that the electrochemical theory is the most accurate of the existing theories, since there is a basis for supposing that the electrochemical factor of corrosion plays the leading part in the process of corrosion cracking. (auth)

244

ON OXIDATION MECHANISMS OF METALS AND ALLOYS. J. Markali (Central Inst. for Industrial Research, Blindern, Oslo). Research (London) 10, 367-9(1957) Sept.

The rate of oxidation of metals as influenced by oxide thickness variations and surface area is discussed. (T.R.H.)

Geology and Mineralogy

245 BM-IC-7801

Bureau of Mines.

MINING METHODS AND COSTS, CONTINENTAL URANIUM, INC., CONTINENTAL NO. 1 MINE, SAN JUAN COUNTY, UTAH. W. L. Dare. Apr. 1957. 23p.

The Continental No. 1 mine is at the south end of the Big Indian mining district, San Juan Co., Utah. A 70,000-ton uranium–vanadium ore deposit was discovered as a result of an exploratory drilling program completed in 1954. Although the Continental No. 1 mine is one of the smaller mines of the Big Indian district, it is larger than the majority of the U mines on the plateau. The ore body is elongated along the east-west strike of the Moss Back member of the Triassic Chinle formation. It is roughly tabular in shape but irregular in outline and dips about 8° to 10° to the south. The ore occurs at the base of the Moss Back, within 2 ft of the Permian Cutler formation. The ore mined to date has an average thickness of about 7 ft. It is developed by a 350-ft slope and a haulageway driven within the ore stratum and mined by open stoping with random pillar support. The height of the ore, its gentle dip, and the strength of the overlying rock have permitted use of trackless loading and haulage equipment. The sections that pertain to location, physical features, history, and geology are brief because much of the same information was given in detail in earlier information circulars on other operations in the district. (auth)

246 NYO-7411

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

AN INVESTIGATION OF THE MINERALOGY, PETROGRAPHY, AND PALEOBOTANY OF URANIUM-BEARING SHALES AND LIGNITES. SCOPE A—SHALES. Fifth Annual Report for the Period of April 1, 1955 to March 31, 1956. Mar. 31, 1956. 113p. Contract AT(30-1)-1202. $3.00(OTS).

Qualitative and semi-quantitative mineralogical and quantitative chemical analyses were made of 205 Chattanooga shale samples and 130 samples of shales from Penna., N. Mex., France, and Sweden. The Chattanooga samples came from nine drill cores representing the area from Northern Tenn. to Central Ala. Whereas in previous work on Central Tenn. cores it was shown that there was a high degree of association of U with bulk composition of the rock, the more extensive study has revealed that there is a regional trend not accounted for in terms of composition that must also be explained if the variation in U content of the shale over a large area is to be adequately explained. Multiple correlations and partial regressions now make it clear that C (representing reducing conditions) and free Fe (oxidation) play a "functional role" with respect to the precipitation and preservation of U, and that pyrite, like the silicates, acts only as a diluent. Investigations of other shale samples show that the Swedish alum shale is very similar to the Chattanooga and the Swedish kolm samples show high correlations of U with C (positive) and with free Fe (negative). The shales from Pennsylvania and France are very similar in that they possess much more kaolinite than the Chattanooga and Swedish samples. (auth)

247 NYO-7708

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Progress Report. July 31, 1957. 46p. Contract AT(30-1)-956. (MITS-36). $1.25(OTS).

Studies are reported on: adsorption of organic and inorganic ions on quartz, flotation of quartz with hexylamine, slime coating, ion exchange properties of muscovite, solvent extraction of W, solvent extraction of transition metals from thiocyanate solutions, intergranular comminution, energy-size reduction, and electrical concentration of minerals. (For preceding period see NYO-7707.) (T.R.H.)

248 RME-3151

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.

PETROGRAPHICAL INVESTIGATION OF THE SALT WASH SEDIMENTS. Final Report. John C. Griffiths. June 25, 1957. 38p. Contract AT(30-1)-1362. $1.25 (OTS).

Quantitative petrographic studies of uranium bearing deposits in the Salt Wash Formation of the Colo. Plateau are reported, and the localizing of uranium deposits in sediments controlled by the differences in petrographic properties between uranium and non-uranium bearing deposits was investigated. (J.E.D.)

249 AERE-Lib/Trans-795

THE REGULARITY OF DISTRIBUTION OF CHEMICAL ELEMENTS IN THE EARTH'S CRUST. A. P. Vinogradov. Translated by S. Botcharsky from Akad. Nauk S.S.S.R., Geokhimiya 1, 1-52(1956). 64p.

250

MINING ACTIVITIES OF THE COMMISSION FOR ATOMIC ENERGY IN 1955. Annales des Mines, 16p. (1956) June. (In French)

251

CONDITIONS OF DEPOSIT AND AGE OF THE URANINITE OF BAS-CAVALLY (IVORY COAST). Jacques Bernazeaud, Arnold Grimbert, Bertrand Lazard, Raoul Roth, and Henri Sanselme. Compt. rend. 242, 2744-6(1956) June. (In French)

252

THE URANINITE OF GRABO (IVORY COAST). Arnold Grimbert. C. R. Sommaire des Seances de la Societe Geologique de France 11, 194-7(1956) June. (In French)

253

PHOTOGEOLOGIC MAP OF THE HOUSE ROCK SPRING SW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-254. J. S. Pomeroy. Washington, U. S. Geological Survey, 1957. $0.50.

254

PHOTOGEOLOGIC MAP OF THE SHINARUMP NE QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-255. Kathleen McQueen. Washington, U. S. Geological Survey, 1957. $0.50.

255

OCCURRENCE OF LONG-LIVED ISOMER POTASSIUM-38 IN NATURE. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/217a. E. K. Gerling, L. K. Levsky, and L. I. Afanassieva. London, Pergamon Press, Ltd., 1957. 5p.

256

ARGON METHOD OF AGE DETERMINATION AND ITS APPLICATION IN PRE-CAMBRIAN GEOLOGY. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/217b. E. K. Gerling. London, Pergamon, Press, Ltd., 1957. 17p.

257

THE NATURAL RADIOACTIVITY OF LUTECIUM-176 AND ITS POSSIBLE APPLICATION IN GEOLOGICAL AGE DETERMINATION. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/218. W. Herr and E. Merz. London, Pergamon Press, Ltd., 1957. 8p.

258

DESCRIPTION OF INDICATOR PLANTS AND METHODS OF BOTANICAL PROSPECTING FOR URANIUM DEPOSITS ON THE COLORADO PLATEAU. Helen L. Cannon. U. S. Geol. Survey Bull. 1030-M. 1957. 123p. $0.50.

Two methods of botanical prospecting for uraniferous deposits on the Colorado Plateau are useful in semiarid country in prospecting for ore-bearing beds at depths as much as 70 feet. By one method, tips of tree branches are sampled and analyzed for uranium content. Generally more than 1 part per million of uranium in the ash indicates favorable ground for further geologic exploration. The second method, that of mapping indicator plants, is used in semiarid parts of the Plateau at low altitude. The distribution of indicator plants is controlled by the availability of chemical constituents of the ore, such as selenium, sulfur, and calcium. Plants of the genus Astragalus are most useful in prospecting for uranium deposits of high selenium content; plants of the genera Allium and Eriogonum are most useful as indicators of deposits with a high sulfur content. Fifty indicator plants commonly associated with carnotite deposits and plants tolerant of mineralized ground are described and illustrated. (auth)

259

URANIUM-BEARING MINERALS IN PLACER DEPOSITS OF THE RED RIVER VALLEY, IDAHO COUNTY, IDAHO. F. C. Armstrong and P. L. Weis. U. S. Geol. Survey Bull. 1046-C. 1957. 15p. and 1 illus. $0.30.

In late 1951 or early 1952 uranium-bearing multiple oxide minerals were first recognized in the jig-bed concentrate of the Tyee Mining Company's gold dredge on the Red River about 10 miles south of Elk City, Idaho Co., Idaho. The gravels of the placer deposits were derived from the Idaho batholith and a roof pendant of Precambrian rocks in the batholith. Three samples taken for analysis show that the jig-bed concentrate contains 0.11% U. The nonmagnetic nonradioactive fractions of the samples assayed 0.2% Nb; columbite was not recognized in the samples. The uranium-bearing placer minerals are brannerite, euxenite, davidite, betafite, and samarskite. Euxenite, samarskite, and betafite, and perhaps ilmenite, also contain Nb. Pegmatites are the probable source of the U- and Nb-bearing minerals, but there is only a remote possibility of finding a pegmatite in the area that can be mined economically for U or Nb. (auth)

260

URANIUM RESOURCES OF THE SAN RAFAEL DISTRICT, EMERY COUNTY, UTAH—A REGIONAL SYNTHESIS. H. S Johnson, Jr. U. S. Geol. Survey Bull. 1046-D. 1957. 21p and 1 illus. $0.40.

261

STRATIGRAPHIC AND STRUCTURAL CONTROLS OF URANIUM DEPOSITS ON LONG MOUNTAIN, SOUTH DAKOTA. William A. Braddock. U. S. Geol. Survey Bull. 1063-A. 1957. 14p. and 4 illus. Available from U. S. Government Printing Office for $1.00.

Numerous occurrences of U have been found in the Long Mountain area, Fall River Co., S. Dak. Correlation diagrams prepared from drill cores indicate that the U is most abundant in two sandstone units, separated by mudstone in the undifferentiated Fuson formation and Lakota sandstone of Early Cretaceous age. The lower uraniferous unit is composed of thick beds of very fine to fine-grained sandstone with a few interfingering lentils of mudstone. The upper uraniferous unit is composed of interfingering beds of very fine-, fine-, and coarse-grained sandstone and mudstone. The U deposits on Long Mountain and in the area to the west are most numerous in a northeastward-trending zone about a mile wide between two normal faults. The sedimentary structures of the upper and lower mineralized sandstone between the faults have locally controlled the deposition of U and V. (auth)

262

THE GOLD PAN AS A QUANTITATIVE GEOLOGIC TOOL. Paul K. Theobald, Jr. U. S. Geol. Survey Bull. 1071-A. 1957. 57p. $0.25.

The gold pan or a similar device has been mentioned throughout recorded history as a valuable instrument for concentrating heavy minerals. The absence of quantitative studies of the accuracy of this tool led to the work presented here. A series of 26 samples of alluvium from the beds and banks of streams were separately panned into a tub and the tailings from each panning were repanned until the remaining concentrate was insignificant. The ratio of the weight of a mineral in the first concentrate from a sample to the total weight of the mineral in the concentrates from all the pannings of that sample, expressed as percent, is termed the recovery and is used as a measure of the accuracy of the gold pan. The recovery of minerals is related to the type of material sampled, the grain size of the mineral, the shape of the grains, and the specific gravity of the mineral. The highest recoveries are from samples containing only small amounts of silt or clay. Samples with large proportions of silt and clay must be washed to remove these constituents before panning may be started, and a part of the heavy minerals is lost in suspension with the clay and silt. Elongate grains of about 65 mesh are most easily saved, and tabular or platy grains are the most difficult to save. There appears to be a direct relation between specific gravity and recovery. The greatest loss of heavy minerals is in the last part of the process of panning

when the proportion of these minerals is greatest. Several suggestions are offered to reduce the effect of these factors and to improve the recovery. The gold pan is an extremely satisfactory tool for concentrating heavy minerals, and with it much valuable information, of both economic and academic importance, can be obtained. (auth)

263

MINERALOGIC CLASSIFICATION OF URANIUM–VANADIUM DEPOSITS OF THE COLORADO PLATEAU. Theodore Botinelly and Alice D. Weeks. U. S. Geol. Survey Bull. 1074-A. 1957. 9p. and 1 illus. $0.40.

The uranium deposits of the Colorado Plateau contain suites of minerals that are the result of different stages of oxidation of deposits with different elemental composition. The classification is based on composition and stage of oxidation, and comprises three groups and the oxidized varieties of each. (auth)

264

A PRELIMINARY REPORT ON THE STRATIGRAPHY OF THE URANIUM-BEARING ROCKS OF THE KARNES COUNTY AREA, SOUTH-CENTRAL TEXAS. REPORT OF INVESTIGATIONS NO. 30. D. Hoye Eargle and John L. Snider. Austin, University of Texas, 1957. 30p.

Uranium has been found in commercial quantities in tuffaceous sandstone containing some clay and organic matter chiefly in the upper part of the Jackson formation of late Eocene age, in Karnes and Atascosa counties, Texas. The rocks containing the uranium-bearing beds are interbedded sandstone and bentonitic clay. In part they are cemented with secondary silica in surface exposures and contain opalized wood. Most of the rocks contain fragments of carbonaceous matter and some prospects contain thin beds of lignite and lignitic clay or tuff. Some of the beds of sandstone contain abundant shells of mollusks, and some of the clay, microfossils. The sandstones are presumed to be chiefly delta and bar deposits that accumulated in low-lying swamps near the coast, which were periodically invaded by brackish or marine waters. Volcanic ash was probably added to the waters as sediment was being washed into the basins. The richest uranium deposits found to date are located in the vicinity of Tordilla Hill, westernmost Karnes County, in an area between the ends of two major en echelon faults. In the vicinity of the deposits, the block lying between these two faults is believed to be cut by smaller faults nearly at right angles to the major ones. The uranium-bearing minerals which have been identified include autunite, carnotite, tyuyamunite, metatyuyamunite, a new unnamed uranyl phosphate, two new unnamed uranium molybdates, fluorescent opal, and schoepite(?). The known deposits found by surface prospecting and near-surface exploration are mostly at depths less than 30 feet below the surface, and they occur mainly in carbonaceous tuffaceous sandstones that have a clay matrix and overlie beds of impervious clay. It is believed by the writers that the source of the uranium was in the tuffaceous sediments and that the uranium, leached from the tuffaceous sediments, was concentrated by evaporation or by interaction with clays and carbonaceous or other materials where ground waters were concentrated in stratigraphic or structural (fault) traps or channels. Occurrences of uranium minerals in the Catahoula tuff, the Oakville sandstone, and the Goliad sand, over an area of about 150 miles to the northeast and southwest, indicate that uranium is widespread in this region. (auth)

265

HOW TO PROSPECT FOR URANIUM. Hubert Lloyd Barnes. New York, Dover Publications, Inc. 125p. $1.00.

This book presents the basic information needed to begin prospecting for U. Information included ranges from equipment (with prices) through techniques for the sale of ore. An index for quick reference and a selected bibliography for detailed information on specific subjects are given. (J.E.D.)

Metals and Metallurgy

266 AD-114771

National Research Corp., Cambridge, Mass.
OXIDATION RESISTANT COATING FOR MOLYBDENUM. Bimonthly Progress Report No. 2 [for] June 1 through July 31, 1956. E. S. Candidus. Aug. 1956. 17p. Contract NOas-56-481-c.

A rotary drum powder coater was completed and tested. Coarse powders were coated with Ni in the device, but work with fine powders is still exploratory. Experiments with Cr, Ni, and Al vapor sources have been performed. Nickel and Al can be evaporated from C containers, and Cr from zirconia. Several Mo–Ni briquettes were pressed and sintered. New dies for powder compacting are under construction. Several methods for sintering powder compacts are being investigated. The method used has been that of radiant heating in high vacuum. (auth)

267 AD-120343

Sintercast Corp. of America, Yonkers, N. Y.
RESEARCH ON HEAT RESISTANT ALLOYS STRENGTHENED AT ELEVATED TEMPERATURES BY INCORPORATION OF FINE PARTICULATE SUBSTANCES. Interim Report No. 5 [for] July 17, 1956 through September 16, 1956. Eric Gregory and Martin Epner. Oct. 1956. 19p. Contract NOas-56-227-C.

Stress-rupture curves are reported for material containing alumina additions made from billets sintered at 2280°F. Although different blending techniques were used, only the material prepared in the Waring Blender showed slight improvement in life when comparison was made with the material without matrix hardener. When the billet sintering temperature was reduced to 2000°F marked improvement in life was noted with most materials, particularly at low stresses and long times. One of the most promising materials was 80-20 Cr–Ni alloy containing 17.5% by volume of "Linde-B" alumina. At 1500°F the life at a stress of 10,000 psi was 88.75 hr, compared with 0.6 hr shown by material with no additions. No curve for the material without additions has as yet been established at 1800°F, but the results from an 80-20 Cr–Ni alloy containing 17.5% by volume of TiC show considerable promise. (auth)

268 AD-124881

Aeroprojects, Inc., West Chester, Penna.
ULTRASONIC WELDING OF STRUCTURAL ALUMINUM ALLOYS. Final Report. Research Report No. 57-13. J. Byron Jones and E. E. Weismantel. Jan. 1957. 92p. Contract NOas-56-161-c.

It was shown that ultrasonic welding will produce spot-type solid-state junctions in 1100-H14, 2024-T3, and 7075-T6 Alclad, and 2024-T3 bare aluminum alloys, meeting the shear strength requirements of MIL-W-6860 for resistance spotwelds in 0.081-inch, 0.064-inch, and 0.051-inch sheet thicknesses, respectively. The process was shown to be effectively supplemented with heat at low temperatures. Continuous-seam type ultrasonic welds were shown to be feasible. Cleaning preparatory to welding was indicated to be less critical than for aircraft-quality resistance spot-welding. (auth)

269 AD-127156

Sintercast Corp. of America, New York.
RESEARCH ON HEAT RESISTANT ALLOYS STRENGTH-

ENED AT ELEVATED TEMPERATURES BY INCORPORATION OF FINE PARTICULATE SUBSTANCES. Summary Report. Eric Gregory and Martin Epner. Dec. 1956. 29p. Contract NOas-56-227-C.

A technique has been established for the production of materials of high density consisting of an 80 to 20 Ni–Cr alloy matrix containing uniform dispersions of hard phase addition agents. The stress rupture properties of this matrix material have been increased considerably at 1500°F, the most favorable results being obtained with titanium carbide additions and Linde B alumina additions. At 1800°F, results are as yet incomplete. Preliminary investigations have been made on different blending techniques which can be employed in the preparation of the mixtures. Materials have also been produced from composite powders made by chemical deposition of nickel on a blend of Cr and the hard phase addition agent in pulverulent form. (auth)

270 AECU-3567

Case Inst. of Tech., Cleveland.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 17 [for] June 2, 1957 to September 2, 1957. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Sept. 30, 1957. 7p. Contract AT[11-1]-258. $1.80(ph OTS); $1.80(mf OTS).

The variation of breakaway time, time for scale color change, and metal growth with temperature for arc and graphite melted Zr in oxygen are presented. (For preceding period see AECU-3529.) (auth)

271 AERE-M/M-107(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME OBSERVATIONS ON URANIUM-RICH URANIUM RUTHENIUM ALLOYS. J. R. Murray and S. J. Lloyd. Jan. 1956. 9p.

The solidus and liquidus depressions in U-rich U–Ru alloys are approximately 5 and 1°C for 0.1 at.% Ru addition, respectively. A eutectic occurs at 900°C and 18 at.% Ru between U and an intermetallic compound of unknown composition. The $\alpha \rightarrow \beta$ and $\beta \rightarrow \gamma$ transformation temperatures in U are lowered by additions of Ru, but in alloys containing up to 20 at.% Ru sharp arrests can be detected at heating and cooling rates of 1½°C/min. The solubility of Ru in γ uranium is approximately 10 at.% at 900°C, the solubility in α uranium being considerably lower. (auth)

272 BMI-1184

Battelle Memorial Inst., Columbus, Ohio.

FABRICATION OF DISPERSED URANIUM FUEL ELEMENTS USING POWDER-METALLURGY TECHNIQUES. Stan J. Paprocki, Donald L. Keller, and George W. Cunningham. May 6, 1957. Decl. Sept. 3, 1957. 44p. Contract W-7405-eng-92. $1.25(OTS).

Fabrication techniques for producing dispersion fuel elements with cores of 30 volume per cent of UC, U_2Ti, U_3Si, or U_6Ni dispersed in Zircaloy 2 and 30 volume per cent of UC or UN dispersed in Type 18-8 stainless steel have been investigated. Roll-clad plate-type elements of all these compositions may be fabricated by powder-metallurgy methods in such a manner that good core-to-cladding bonds and cores with uniform dispersions of discrete uranium-compound particles are obtained. From the standpoint of fabricability, elements containing UC in Zircaloy 2, UC in stainless steel, and UN in stainless steel are the most promising. The UN in stainless steel has the best corrosion resistance in 680°F degassed water; however, UC in stainless steel has the best resistance to corrosion in 700°F NaK. (auth)

273 BMI-1224

Battelle Memorial Inst., Columbus, Ohio.

HIGH-STRENGTH MATERIALS FOR PRESSURIZED-WATER IN-PILE TUBES. Ward F. Simmons, Walter K. Boyd, Raeman P. Sopher, and Fred H. Lyon. Sept. 16, 1957. 45p. Contract W-7405-eng-92. $1.75(OTS).

The preliminary work done by Westinghouse on properties of materials suitable for the in-pile testing facility was reviewed. Information was collected on a selected list of promising materials in the following classifications: alloy steels, chromium steels, precipitation-hardening stainless steels, and superalloys. On the basis of the information obtained from Westinghouse, from the literature survey, from Battelle files, and from visits to producers, it is recommended that Phase II of the program be confined to Inconel X hot rolled and aged, AM-350 subzero cooled and tempered, and Discaloy solution treated and aged. (auth)

274 CF-56-2-170

Rensselaer Polytechnic Inst., Troy, N. Y.

THE BRAZING OF ALUMINUM BRONZE TO INCONEL. Progress Report [for] September 15, 1955 to February 1, 1956. D. Caplan, J. J. McCarthy, and E. F. Nippes. Feb. 13, 1956. 27p. For Oak Ridge National Lab. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

The requirements of an atmosphere for the brazing of Al bronze to Inconel were considered on a thermodynamic basis. It was demonstrated that brazing was not possible in a vacuum or inert gas and is improbable in dry H_2. Attempts to braze in dry H_2 prove unsuccessful as predicted, except at isolated spots where filler metal had been preplaced. Modification of the plastic binder for holding the filler metal so as to remove O_2 and introduce halogen gave no improvement. Negative results were also obtained when solid halide or halogen was incorporated. Satisfactory brazing was achieved with various solid fluxes. Consideration was given as to what must be the properties of such a flux so that it should not have deleterious affects in service. (auth)

275 CF-56-6-183

Rensselaer Polytechnic Inst., Troy, N. Y.

THE BRAZING OF ALUMINUM BRONZE TO INCONEL. Interim Report No. 2 Covering the Period February 1, 1956 to June 1, 1956. D. Caplan, J. Hauser, and E. F. Nippes. June 15, 1956. 57p. For Oak Ridge National Lab. Contract W-7405-eng-26. $9.30(ph OTS); $3.60 (mf OTS).

It is demonstrated that Al bronze can be brazed to Inconel with Ni-base filler metal in a H_2 atmosphere without flux in spite of the unfavorable thermodynamics. This necessitates H_2 of a high degree of purity and a rapid heating rate in bringing the work to brazing temperature. In brazing an actual heat exchanger, neither of these conditions is readily fulfilled, since the size of the unit makes for a slow heating rate and its complexity, combined with the fact that O_2 is liberated by the dissociation of the oxide film on the Inconel, leads to local contamination of the atmosphere. Laboratory experiments with tube-and-fin specimens designed to simulate these conditions result as expected in failure to braze. These adverse conditions can be overcome by the use of a suitable flux in conjunction with the dry H_2 atmosphere. Borate-base fluxes are effective but are considered undesirable on the basis of low solubility and consequent risk of corrosion failures in service. Fluxes based on mixed halides are found to be successful in promoting brazing. Since such fluxes are more readily soluble they are not expected to contribute a corrosion hazard. A preferred mixture is 5 parts NaCl, 2 parts LiCl and 1 part CuCl. With this flux, smoothly-filleted joints

are obtained exhibiting adequate penetration into the crevice. A mechanism by which the halide-base flux operates is proposed on a thermodynamic basis. This mechanism is somewhat tentative in nature pending further experimental work but depends on decreasing the activity of O_2 in the flux and of Al in the bronze sufficiently that the product $a_{Al}^2 \cdot a_0^3$ does not exceed the deoxidation constant for the oxidation of the Al. (auth)

276 CF-57-3-160
Oak Ridge National Lab., Tenn.
EFFECTS OF HEAT TREATMENT ON MICROSTRUCTURE AND FABRICABILITY OF 48 WT. % URANIUM–52 WT. % ALUMINUM ALLOYS. William C. Thurber. Mar. 15, 1957. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

This investigation was undertaken to establish the feasibility of spheroidizing the eutectic in 48 wt. % U–Al alloys with the ultimate goals being reduction of edge cracking during hot rolling of the core alloy and diminution of dog-boning during hot rolling of composite fuel plates. It was felt that the problems of edge cracking and dog-boning, which were recurrent during development of the 48 wt. % U–Al alloy for Foreign Reactor Program applications, might both be minimized with a heat-treated alloy. (auth)

277 CF-57-9-60
Oak Ridge National Lab., Tenn.
RECENT DEVELOPMENTS IN THE POWDER METALLURGY APPLICATION OF URANIUM OXIDES TO ALUMINUM RESEARCH REACTOR FUEL ELEMENTS. R. C. Waugh and R. J. Beaver. Sept. 16, 1957. 14p. $3.30 (ph OTS); $2.40(mf OTS).

The restriction of U^{235} enrichment to 20% for exportable reactor fuels led to investigations of uranium oxide–Al fabricability. The fabrication characteristics and stability of plate-type elements of U_3O_8 (prepared from $UO_3 \cdot H_2O$), UO_2 (steam oxidized), UO_2 (H_2 reduced), and UO_2 (He reduced), in Al powder and Al clad are reported. The U_3O_8–containing elements possessed better metallurgical properties. (D.E.B.)

278 ERI-2447-6-P
Michigan. Univ., Ann Arbor. Engineering Research Inst.
ELECTRON METALLOGRAPHIC INVESTIGATIONS OF THE MINOR PHASES OF HEAT-RESISTANT ALLOYS. Progress Report No. 1 [for] October 15, 1955 to January 15, 1956. W. C. Bigelow, J. A. Amy, and L. O. Brockway. Apr. 1956. 16p. AF Project No. 6(8-7351). Contract AF33(616)-3250. (AD-119224).

Progress is reported in the experimental work on studies of etching reagents for preparing S816 alloy specimens for electron metallographic examinations, studies of the microstructures of three commercial nickel-base alloys, M-252, Waspalloy, and Udimet, to determine the distribution of the age-hardening γ' precipitate phase, studies of the microstructure of an experimental alloy containing higher percentages of Ti and Al than the above commercial alloys, and electron microscopic studies of a low-strength heat of a nickel-base alloy having an unusual banded structure. (auth)

279 IGE/R-1
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
STRESSES IN WELDS JOINING CALDER HALL PRESSURE VESSEL TO SUPPORTING FEET. W. H. Irvine. Sept. 27, 1955. 13p. (IGC-TRDC/P-122).

The differential expansion between the pressure vessel and the supporting feet causes each of these to be subjected to a bending moment which is transmitted to the pressure vessel shell via the welds between the feet and cheek plate and the cheek plate and pressure shell. By making an estimate of the rigidity of the shell and of the coefficient of friction at the feet, this bending moment is determined, and therewith the stresses in the weld between foot and cheek plate. From an estimate of the torsional rigidity of the cheek plate, the distribution of the resisting moment along the weld between the cheek plate and pressure vessel is calculated, and therewith the maximum shear stress in this weld. It is concluded that dangerous stresses may arise under Wigner release conditions, and measurements are suggested to check this conclusion. (auth)

280 ISC-906
Ames Lab., Ames, Iowa.
TABULATION, BIBLIOGRAPHY, AND STRUCTURE OF BINARY INTERMETALLIC COMPOUNDS. III. COMPOUNDS OF COPPER, SILVER AND GOLD. H. H. Klepfer, H. E. Shoemaker, J. K. Greiner, M. L. Moller, and J. F. Smith. Sept. 9, 1957. 48p. Contract W-7405-eng-82. $1.25(OTS).

281 KAPL-M-ROF-1
Knolls Atomic Power Lab., Schenectady, N. Y.
WELDING OF S3G ZIRCALOY 2 INSTRUMENTED FUEL ELEMENT MOUNTING. R. J. Flint, K. H. Koopman, and J. M. Gerken. Sept. 12, 1957. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The Submarine Advanced Reactor (S3G) instrumented fuel elements were welded into their respective fuel element subassemblies. The mount design is discussed, and some changes are suggested to produce better welding procedures. Welding tests made on sections of size and shape similar to those used in the subassembly are described. Good weld joint design, weld fixturing, and welding conditions for making full penetration welds joining S3G instrumented fuel elements to end strips were studied. (auth)

282 KAPL-M-SAT-5
Knolls Atomic Power Lab., Schenectady, N. Y.
TUNGSTEN-ARC SPOT WELDING OF STAINLESS STEEL STAKING PINS INTO DOWEL PINS FOR S3G UNIT CELL. S. A. Toftegaard. Aug. 23, 1957. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The transition castings and Zircaloy tube structure for the S3G unit cell are secured in position by stainless steel dowel pins. To insure that the dowel pins remain in place, staking pins are placed in both ends of these dowel pins. The original design called for peening around the periphery of the staking pins to secure them. An investigation was carried out to determine if the staking pins could be heliarc spot welded in place without exceeding 400°F temperature at the points of contact between the stainless steel dowel pin and the Zircaloy tube structure. It is concluded that the staking pins could be heliarc spot welded in place when good timing and welding control are used. (auth)

283 NACA-TN-4112
Langley Aeronautical Lab., Langley Field, Va.
GENERALIZED MASTER CURVES FOR CREEP AND RUPTURE. George J. Heimerl and Arthur J. McEvily, Jr. July 8, 1957. 31p.

The similarity of Larson-Miller master curves for creep rate, rupture life, and creep strain is shown for a number of materials. By the use of the approximate invariance of the product of creep rate and rupture life, the individual master curves are generalized into a single curve which is the same as the master curve for rupture. From this master curve, the creep rate and various amounts of creep strain can be predicted. (auth)

284 NYO-7828
Carnegie Inst. of Tech., Pittsburgh.
STRAIN AMPLITUDE DEPENDENT INTERNAL DAMPING EFFECTS IN ALUMINUM AND MAGNESIUM SINGLE CRYSTALS. Robert Harry Chambers. Sept. 7, 1957. 120p. Contract AT(30-1)-1193. $18.30(ph OTS); $6.00 (mf OTS).

Internal damping and relative Young's modulus measurements were made of single crystals of four nines pure Al and Mg and single crystals of zone refined Al in the kilocycle range. Particular attention was placed on strain amplitude dependent effects; measurements were made from room temperature to 400°C at strain amplitudes from 10^{-7} to 10^{-5} and as a function of thermal and mechanical history. Time dependent effects were studied in some detail, and a correlation was made with these effects and certain anomalies in the amplitude dependent behavior. The amplitude dependent effects were described in terms of the pinned dislocation model of Granato and Lücke. It was concluded that this model can explain the above findings if it is assumed that the active dislocation density is of the order of 1/10 to 1/100 of the total dislocation density. It is believed that the time dependent effects can be attributed to the redistribution of the point-type imperfection atmosphere surrounding the dislocations. (auth)

285 NYO-7919
Aeroprojects, Inc., West Chester, Penna.
APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 5 Covering Period from June 16, 1957 to August 15, 1957. Aug. 1957. 56p. Contract AT(30-1)-1836. $9.30(ph OTS); $3.60(mf OTS).

Studies on the effects of direct-coupled ultrasonic energy on dissolution of Type 304 stainless steel in HNO_3-HCl and of Zircaloy-2 in HNO_3-HBF_4 and HNO_3-H_2SO_4 solutions were continued, and positive ultrasonic effects were observed with both metals. Ultrasonic treatment of Zircaloy-2 in several molten salts was not fruitful. Although tests of ultrasonic influence on electrolytic dissolution of both metals were essentially negative, they suggest further study. Vibratory treatment at 470°C of Th-Bi mixtures effected substantial platelet breakup, the degree of which appeared to depend on treatment time and power level. In tests in which various vibration modes were applied to powdered Fe during compaction, only application in a bell mode produced a positive effect on compact density. Mold fill experiments indicated that appropriate ultrasonic treatment increased the amount of metal that could be contained in a die. Preliminary design was completed for an ultrasonic treatment capsule for investigating particle breakup in a UO_2-NaK system. Studies of ultrasonic control of crystal size during aqueous precipitation of $Th(C_2O_4)_2$ were undertaken. In initial work with a simulant system of $Ca(NO_3)_2$ and $H_2C_2O_4$, it was established that oxalate crystals could be prepared in various sizes and possibly smaller than 1 μ. Preliminary study was made of the feasibility of developing an ultrasonic pumping system for circulating core solution in a reactor such as the LAPRE II. Using a simulant sucrose solution, qualitative studies were made of ultrasonic flow characteristics obtained under various conditions. (For preceding period see NYO-7918.) (auth)

286 NYO-8529
Penn-Texas Corp., New York.
EFFECT OF POWDER PARTICLE SIZE ON THE GRAIN SIZE OF THE SINTERED MATERIAL. Henry H. Hausner and R. King. Oct. 1, 1957. 15p. Contract AT(30-1)-1991. $3.30(ph OTS); $2.40(mf OTS).

Metal powder compacts, when exposed to sintering conditions, show grain growth which is determined by the temperature and time of sintering. The rate of grain growth is delayed by the pores between powder particles, which act similarly to the way impurities do in solid metals. During sintering the compact densifies and the pores undergo three different types of change: they decrease in size; they collect and form larger ones, and therefore decrease in number; and, finally, they change in shape and spheroidize. Experimental work indicates that the grain growth is delayed by porosity only up to a certain configuration of the voids. The rate of grain growth increases rapidly when spheroidization of the voids takes place. Smaller pores, such as obtained by compacting fine metal powders, spheroidize faster than the larger pores in coarse particle compacts, and the more rapid grain growth, therefore, starts earlier in compacts made from small powder particles. (auth)

287 ORNL-2149
Oak Ridge National Lab., Tenn.
BORON-ALUMINUM AND BORON-URANIUM-ALUMINUM ALLOYS FOR REACTOR APPLICATION. W. C. Thurber, J. A. Milko, and R. J. Beaver. Oct. 17, 1957. 25p. Contract W-7405-eng-26. $1.00(OTS).

Additions of small quantities of the burnable poison, B, in Al reactor fuel elements offer the possibility of reducing undesirable neutron-flux perturbations, especially those caused by fuel burnup. This report describes techniques for induction melting of B-Al and B-U-Al alloys for producing materials with maximum homogeneity. Of the several B additions investigated, a nominal 12 wt. % B-Ni master alloy was the most satisfactory for preparing B-U-Al castings, while both 1.5 to 5 wt. % B-Al and 12 wt. % B-Ni master alloys were suitable for preparing B-Al castings. Data are presented which indicate that B improves the strength of Al. The corrosion resistance of a nominal 0.1 wt. % B-0.8 wt. % Ni-Al alloy is comparable with type 1100 Al in distilled and aerated water at both 60 and 100°C. Without the Ni, this alloy appears to be marginal in these environments. (auth)

288 PM-203(Can)
Canada. Dept. of Mines and Technical Surveys, Mines Branch.
DIATOMIC GASES IN METALS AND HYDROGEN EMBRITTLEMENT OF TITANIUM. Review of Literature. O. Z. Rylski. Apr. 17, 1956. 82p.

Hydrogen should be considered as one of the embrittling factors harmful to the engineering properties of Ti alloys. Hydrogen content can be controlled by proper treatment and careful processing technique and kept at a level below that considered at present as detrimental. Tolerances for H should be considered from the point of view of allowable brittleness for each particular application. Methods of testing embrittlement should be evaluated and specifications of acceptance set separately for alloys according to their application, strength required, composition of alloy, and heat treatment to be used. (auth)

289 RDB(C)/TN-113
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
STRESS-RELAXATION TESTS ON WELDED SPECIMENS OF CONSETT "LOW-TEM" STEEL. A. J. Fenner and A. Cowan. Apr. 15, 1955. 13p. (TRDC/P-89).

The possible effects of internal stresses in welded structures with particular reference to problems associated with the pressure shell of the Thermal Reactor are reviewed. Laboratory stress-relaxation tests on material from welds and plate, carried out in creep testing machines at temperatures of 350 and 400°C and heat treatment of bars strained in bending are described. The results of the tests may be of value in the event of difficulties arising which prevent the attainment of a fully stress-relieving tempera-

ture when the stress-relieving of the pressure vessel is undertaken. (auth)

290 TML-46B
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM. Status Report No. 2. C. R. Simcoe. Sept. 25, 1957. 51p.

This report summarizes the progress on the titanium sheet-rolling program. Progress is reported from the three titanium producers as well as several aircraft companies. The bulk of the sheet in this program is ready for solution treatment. Data are shown on solution-treated and solution-treated and aged properties of a number of alloys. (auth)

291 TML-80
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
MANUAL ON THE MACHINING AND GRINDING OF TITANIUM AND TITANIUM ALLOYS. Carl T. Olofson. Aug. 20, 1957. 89p. Contract AF18(600)-1375.

The purpose of this manual is to present information and data on various machining processes commonly employed for Ti. It is intended to serve as a guide or starting point from which machining recommendations for specific parts can be derived. The manual itself consists of an introductory section, seven machining sections, and two appendixes. Of course, the "meat" of the information is in the machining sections. Each machining section is composed of three subsections: (1) General information, (2) Information on tool materials and shapes, and (3) Operational information and data. Sketches are used to describe pertinent tool geometry and all sections include a list of suitable reference material. Appendix A contains four tables: a list of Ti alloys and their producers, machinability ratings, a list of tool materials used, and a table for converting speeds in surface feet per minute to revolutions per minute. Appendix B describes the properties of Ti and their influence on machining behavior. (auth)

292 WADC-TR-54-492(Pt. III)
Climax Molybdenum Co. of Michigan, Detroit.
OXIDATION-RESISTANT COATINGS FOR MOLYBDENUM. Final Report. D. V. Doane. Apr. 22, 1957. 103p. Project title: METALLURGY AND METALLIC MATERIALS. Task title: CORROSION AND HEAT RESISTING ALLOYS. Contract AF33(616)-2488. (AD-130894).

Tests to evaluate the ductility and relative resistance to oxidation, thermal cycling, ballistic impact, and erosion were completed on specimens of unalloyed molybdenum and 0.5% titanium–molybdenum alloy coated with the following materials: aluminum–chromium–silicon sprayed-metal coating; nickel–chromium–boron sprayed-metal coatings; nickel–silicon–boron sprayed-metal coating; electroplated chromium; electroplated chromium–nickel composite; and nickel cladding. The evaluation tests were conducted at 1800°F. Other tests included determination of ambient temperature ductility of coated molybdenum and oxidation tests at temperatures up to 3000°F. The reported "self-healing" characteristics of aluminum–chromium–silicon coatings were investigated. Modifications to promising coating compositions were explored. (auth)

293 WADC-TR-57-232
Battelle Memorial Inst., Columbus, Ohio.
AN INVESTIGATION OF THE EFFECTS OF VARIATIONS IN THE DEGREE OF HETEROGENEITY ON THE HIGH-TEMPERATURE PROPERTIES OF CERTAIN COPPER–NICKEL SOLID-SOLUTION ALLOYS. Harold J. Hucek, Arthur R. Elsea, and George K. Manning. June 26, 1957. 35p. Contract AF33(616)-3286. (AD-118205).

Homogenizing increases the 750°F rupture strength of Cu-Ni solid-solution alloys. This was shown by preparing alloys of Cu and Ni powders and varying the powder size and sintering time to produce alloys with varying degrees of heterogeneity. In these solid-solution alloys, the grain size, pore size, and density were held as nearly constant as possible to minimize their effects on the properties. For a given degree of homogeneity the 50-50 alloy was stronger at 750°F than was the 70-30 Cu-Ni alloy. The results of this investigation indicate that the increased rupture life of certain as-cast high-temperature alloys as compared with the more homogeneous wrought or heat treated alloys is not the result of increased heterogeneity of the solid-solution matrix. (auth)

294 WAL-401/214-4
New York Univ., New York. Coll. of Engineering.
RESEARCH AND DEVELOPMENT WITH RESPECT TO THE Ti–Al–O SYSTEM. Final Report. E. Ence and Harold Margolin. June 1957. 36p. DA Project 5B93-08-021. Contract DA-30-069-505-ORD-1781.

Evidence has been adduced which required modification of the previously accepted Ti–Al diagram. Microstructure and x-ray evidence has been obtained for a phase identified as Ti_2Al; microstructure and x-ray evidence has been detected for several other phases. The tentative Ti–Al diagram has required modification inasmuch as additional investigation has not supported the existence of the δ-phase. No evidence for the reaction $\beta + TiAl \rightarrow \alpha$ has been found. There is some basis, however, for believing that Ti_2Al (the α phase in earlier diagrams) forms peritectically by the reaction $L + \beta \rightarrow Ti_2Al$ and that TiAl also forms peritectically by the reaction $L + Ti_2Al \rightarrow TiAl$. There are inconsistencies in both x-ray and microstructural data which prevent a final conclusion as to phase relations. Based on available evidence several possibilities are discussed. (auth)

295 WAPD-PWR-PMM-643
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR ALTERNATE CONTROL ROD MATERIAL PROGRAM. E. F. Losco and H. J. Snyder. Oct. 15, 1956. 33p. $6.30(ph OTS); $3.00(mf OTS).

Experimental data obtained on PWR alternate control rod materials are reported. The materials investigated are made up of a number of volume ratios of B_4C–Cu, B-stainless steel, and Cd–In–Ag. Data on water corrosion, tensile properties, dimensional stability, and fabrication are given. (D.E.B.)

296 AEC-tr-3053
SOLID SOLUTIONS OF METALLIC COMPOUNDS. I. I. Kornilov. Translated from Doklady Akad. Nauk S.S.S.R. 81, 597-600(1951). 6p.

297 AEC-tr-3060
CRYSTAL STRUCTURES OF SOME METALLIC COMPOUNDS OF BISMUTH. G. S. Zhdanov. Translated by J. Adam from Trudy Inst. Krist. Akad. Nauk S.S.S.R. 10, 99-116(1954). 15p.

An x-ray study of crystal structures of intermetallic compounds of Bi with Ni, Rh, and Pd is presented. (J.E.D.)

298 IGRL-T/C-42
A METHOD FOR THE DETERMINATION OF POISSON'S RATIO BY DIRECT MEASUREMENT OF TRANSVERSE CONTRACTION AND LONGITUDINAL EXTENSION. K. Claus. Translated by J. Standring from Z. Metallkunde 46, 589-92(1955). 11p.

Determination of Poisson's ratio is usually obtained from a calculation using the elastic and shear moduli. This

assumes specimens and strains which fit the basic assumptions of the elastic theory: quasi-isotropic material, infinitely small strains. These conditions are often not fulfilled. A method was therefore devised to measure lateral contraction which permitted Poisson's ratio to be determined directly from lateral contraction and longitudinal strain. The lateral contraction is translated mechanically into a change of inductance and this is measured on an a-c bridge. For standardization an apparatus is used with which definite changes of length of the order of 10^{-6} mm can be produced. By suitable adjustment of the inductive transmitter on the specimen, substantial temperature compensation of the measuring arrangement for particularly accurate determination is obtained. The accuracy of measurement from the curves plotted is 40 A, corresponding to a useful magnification of 250,000. The range of measurement thereby spans four powers of ten. The longitudinal strain is measured simultaneously with Marten's apparatus. Poisson's ratio may be determined accurate to about 5% with a lateral contraction of 2×10^{-5} mm/mm. With 10^{-4} mm/mm the uncertainty scarcely amounts to 1%. (auth)

299

MICROGRAPHIC EXAMINATION OF THE LOW-TEMPERATURE RECRYSTALLIZATION OF ALUMINUM PURIFIED BY THE ZONE-MELTING METHOD. Philippe Albert and Omurtague Dimitrov. Compt. rend. 245, 681-3(1957) Aug. 5. (In French)

The perfection of a technique for electrolytic polishing and anodic oxidation of pure Al at low temperature (−60°C) is demonstrated by the micrographic structure of a sample of high-purity Al recrystallized at −38°C after cold rolling to a 97% reduction. (tr-auth)

300

NEW TYPES OF SOLID SOLUTION IN HIGH Ti SLAGS. A. V. Rudneva, M. S. Model, and T. Ya. Malysheva (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 115, 141-4(1957) July. (In Russian)

Investigations revealed a new series of unlimited miscibility solid solutions of $2\,MgO \cdot TiO_2 - 2FeO \cdot TiO_2$, and $(Fe, Mg, Mn)O \cdot TiO_2 - Ti_2O_3$ whose mixed crystals play an important part in the phase content of high Ti slags. The silicate phase of the high Ti slags, the Ti augite, is a complex solid solution formed along the chain structure of the anion radical $(Si, Al)_2O_6$. (R.V.J.)

301

THE STATIC RESISTANCE OF Al−Zn, Al−Mg, AND Al−Cu ALLOYS. I. N. Fridlyander, N. M. Edel'man, and Yu. S. Danilov. Doklady Akad. Nauk S.S.S.R. 115, 287-9(1957) July 11. (In Russian)

Slow repetitive loading causes disintegration of material at a reduced number of cycles as compared to high-frequency alternating loading. Experiments were made of loading at 6 to 8 cycles per minute. Diagrams are given of the mechanical changes and static resistance of Al−Zn, Al−Mg, and Al−Cu alloys, and of the effects of Cu content and aging temperature on the resistance of the alloys. (R.V.J.)

302

NIOBIUM: THE MEDIUM-RARE METAL. Ind. Eng. Chem. 49, 42A-7A(1957) Oct.

The uses, chemical properties, production, and relative abundance of Nb is given. (W.L.H.)

303

TITANIUM AND ZIRCONIUM CASTING DEVELOPMENTS BY THE U. S. BUREAU OF MINES. A. H. Roberson (Bureau of Mines, Albany, Oreg.). J. Inst. Metals 86, 1-6 (1957) Sept.

Casting studies conducted by the U. S. Bureau of Mines laboratory at Albany, Oreg., are described which demonstrate that titanium and zirconium castings weighing up to 75 lb can be produced successfully without any contamination. Two types of consumable-electrode arc-melting furnace have been used: bottom-pour crucible and tilting crucible models. Skull melting in water-cooled copper crucibles prevents contamination by crucible materials. Massive scrap, clean chopped machine turnings, and sponge can be fabricated into satisfactory electrodes. Mold materials that have proved satisfactory include machine graphite, rammed granular graphite, and copper or aluminum. (auth)

304

DYNAMIC SOLUTION-RATE STUDIES OF SOLID METALS IN LIQUID METALS. A. G. Ward (Atomic Energy Research Establishment, Harwell, Berks) and J. W. Taylor (Babcock and Wilcox, Ltd., Renfrew). J. Inst. Metals 86, 36-42(1957) Sept.

A study has been made of the kinetics of solution of solid Cu in liquid Pb and Bi under dynamic conditions in the temperature range 360 to 460°C, and the solution process is shown to conform to an expression of the form: $n_t = n_0(1-e^{-Kt(S/V)})$, where n_t = solute concentration at time t, n_0 = saturation concentration at a fixed temperature, K = solution-rate constant, S = surface area of solid exposed, V = volume of solvent. This expression is similar to that which applies in nominally static tests. From the variation of K with temperature and velocity in the two systems studied, it is concluded that the effective rate-controlling step in the dissolution process, under dynamic conditions, is the rate at which solute atoms are transferred from a saturated layer at the solid/liquid interface into the bulk of the liquid by turbulent and convective flow. The validity of a general relationship between the reduced concentration (n_t/n_x) and the reduced time (t/t_x) is established for dissolution at any temperature and under any dynamic condition; n_x is any fraction, x, of the saturation concentration n_0, and t_x is the time for the concentration to reach n_x. The use of this general relationship in interpolating complete concentration/time curves from limited experimental data is outlined. (auth)

305

GRAIN GROWTH IN METALS, WITH SPECIAL REFERENCE TO HIGH-PURITY NICKEL. Paul Feltham (The Univ., Leeds). J. Inst. Metals 86, 95-7(1957) Oct.

Grain growth in 99.99% nickel has been studied in the range 700° to 900°C. The initial and instantaneous mean grain diameters, D_0 and D, were found to be related to the time t of isothermal annealing by the expression $D^2 - D_0^2 = Kt$, where $K = K_0 \exp(-H/kT)$. The functional form of this relation, as well as the magnitudes of the parameter K_0 (= 0.8 cm^2/sec.) and of the activation energy H(= 32 k.cal./g.-atom) are as required by the generalized statistical theory of grain growth previously advanced. (auth)

306

ELECTROLYTIC PREPARATION OF THORIUM METAL. B. C. Raynes, M. E. Sibert, and M. A. Steinberg (Horizons Inc., Cleveland, Ohio) and J. C. Bleiweiss (Dow Chemical Co., Midland, Mich.). J. Metals 9, 1373-80(1957) Oct.

Thorium chloride dissolved in molten NaCl can be electrolyzed in a continuous process for the production of granular, high purity Th metal powder. The preparation of anhydrous chloride, its electrolysis in an expanded scale cell, and the purity and some mechanical properties of the product Th are described. (auth)

307

THE CRYSTAL STRUCTURE OF $KCu(CN)_2$. Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 1388-92(1957) Oct.

$KCu(CN)_2$ is monoclinic, space group $P2_1/c(C_{2h}^5)$ with four formula units per unit cell. The cell constants are a = 7.57, b = 7.82, c = 7.45 A. and $\beta = 102.2°$. The trial structure was deduced from a three-dimensional Patterson followed by a three-dimensional Fourier synthesis. This structure was refined by the least-squares method. All computations were made on the Maniac. The analogous silver and gold compounds have discrete linear complex ions formed by sp hybridization of the metal. The copper compound has an entirely different structure. The complex ions form spiral polymer chains of composition $[Cu(CN)_2^-]_\infty$. The twofold screw axes pass through the centers of the chains. The chains are held together by the K^+ ions. The Cu atom has assumed a threefold hybridized state, probably a distorted sp^2 hybrid. The $Cu(CN)_2^-$ units are held together by a Cu−N bond of 2.05 ± 0.02 A. One CN group forms this bond while the other CN group protrudes from the chain. Good evidence is presented for making a distinction between the C and N atoms. The two Cu−C bond lengths are 1.92 ± 0.02 A. The C−N bonds are 1.15 ± 0.03 and 1.13 ± 0.03 A. The C−Cu−C angle is 134.2 ± 0.9°. (auth)

308

INTERMETALLIC COMPOUNDS BETWEEN LITHIUM AND LEAD. III. THE $\beta'-\beta$ TRANSITION IN LiPb. Allan Zalkin and William J. Ramsey (Univ. of California, Livermore). J. Phys. Chem. 61, 1413-15(1957) Oct.

The high temperature β phase of LiPb has the body-centered cubic CsCl structure, while the low temperature β'-phase has a derivative rhombohedral structure. (auth)

309

EXTRUSION OF A COMPLEX SHAPE THROUGH A ROUND DIE. William E. Ray (Knolls Atomic Power Lab., Schenectady, N. Y.). Metal Progr. 72, No. 3, 65-9(1957) Sept.

A long, straight control rod of Y-shaped cross section for a nuclear reactor is made by canning flat cermet compacts, assembling them with appropriate inserts of soft steel to fill a sealed sheath, hot extruding the combination, and then dissolving the soft steel inserts in acid, leaving behind the required stainless-clad rod. (auth)

310

EXPLOSION OF A TITANIUM CRUCIBLE. Clo E. Armantrout and June R. Hauger (Bureau of Mines, Albany, Ore). Metal Progr. 72, No. 3, 94-5(1957) Sept.

In a fusion test a Ti crucible was charged with a high-chromium slag, Na_2O_2, and Na_2CO_3. The temperature of the fusion was ~750°, as indicated by a dull-red appearance of the charge. After a time lapse the charge became white hot. As the crucible was being set on a stone bench it exploded with a bright flash and a loud sharp report. No explanation was given for the explosion but it is strongly recommended that extreme caution be used in contacting Ti with highly oxidizing substances. (W.L.H.)

311

TWO PROMISING NEW TITANIUM ALLOYS. S. Abkowitz and Dillon Evers. (Mallory-Sharon Titanium Corp., Niles, Ohio.) Metal Progr. 72, No. 3, 97-102(1957) Sept.

An alloy with 2.5% Al and 16% V is readily formable and then age hardened to 160,000 psi. yield strength retaining 5% elongation. An alpha alloy with 8% Al, 2% Cb and 1% Ta is weldable in bar and sheet form and extends the temperature limit of usefulness 200°F over conventional alpha alloys. (auth)

312

SUPERPURITY NICKEL MELTED UNDER CONTROLLED ATMOSPHERES. K. M. Olsen (Bell Telephone Labs., Inc., Murray Hill, N. J.). Metal Progr. 72, No. 3, 105-9(1957) Sept.

High-purity Ni can be made by melting sintered slugs of carbonyl Ni powder in MgO crucibles under a definite program of H_2, vacuum, and He atmospheres. The process is also effective for high-purity binary Ni alloys and Fe alloys. (W.L.H.)

313

VACUUM INDUCTION MELTING, PROCESS CONSIDERATIONS. W. E. Jones (General Electric Co., Detroit, Mich.). Metal Progr. 72, No. 4, 133-8, 220, 222(1957) Oct.

Successful vacuum melting was found to require high vacuum, leak-tight equipment, pure melting stock, and crucible materials. Reactive metals added at the end of the heat alloy with the melt rather than form undesirable inclusions. Notable improvements result in high-temperature properties of heat resistant alloys. (auth)

314

EXTRACTION AND REFINING OF THE RARER METALS. London, The Institution of Mining and Metallurgy, 1957. 459p.

Titles of papers included in this symposium are as follows: General Chemical Principles in Extraction of Metals from Low Grade Ores; Purification by Solvent Extraction; Studies in the Chlorination of Wolframite, Vanadinite, and Chromite; An Oxide-Chloride Conversion Process for the Extraction of Certain Metals; Metallurgical Developments in the Recovery of Some of the Less Common Metals in Canada; Extraction of Some Less Common Metals from Smelter and Refinery Intermediate at La Oroya, Peru (Se, Te, and Tl); The Chemical and Physical Concentration of U Ores; Recovery of U from Sulfate Leach Solutions by Anion Exchange; Factors Influencing the Mg Reduction of UF_4; Pilot Plant Concentration of Mindola U Ore; Processes for Extraction of V; The Production of High-Purity V Metal; Flotation of V Ores from the Abenab West Mine of the South West Africa Co.; The Selection of a Process for Development for Production of Pure Nb; The Extraction of Pure Nb by a Chlorination Process; Distillation of Volatile Chlorides as a Means of Obtaining Pure Nb; Beryllium Production at Milford Haven; The Preparation of Be Metal by Thermal Reduction of the Fluoride; Purification of Metals by Intermediate Formation of Their Stable Halide Vapors with Application to Be and Ti; The Extraction of Th From Monazite; Some Investigations Into Extraction of Ti by Fused Salt Electrolysis; and The Manufacture of Hf-Free Zr. Discussions following the presentation of the papers and the authors' replies are included. (J.E.D.)

315

BERYLLIUM. G. L. Miller (Murex, Ltd.). Nuclear Power 2, 362-5(1957) Sept.

The availability and methods of production of Be are surveyed in view of interest in it as a high-temperature canning material for Calder-type fuel elements. (T.R.H.)

316

THE METALLURGY OF NIOBIUM. M. D. Jepson (United Kingdom Atomic Energy Authority, Risley). Research (London) 10, 390-5(1957) Oct.

The unusual combination of properties required of metals used in the cores of advanced nuclear reactors has necessitated detailed consideration of the possibility of using the rarer metals. Of these, niobium, overshadowed industrially by tantalum, was known to possess good nuclear properties and was also reported to have promising physical and mechanical characteristics. Its corrosion behavior and alloying properties also appeared favorable, and consequently it was selected for further study and development. (auth)

317

AN INVESTIGATION OF THERMAL-STRESS FATIGUE AS RELATED TO HIGH-TEMPERATURE PIPING FLEXIBIL-

ITY. L. F. Coffin, Jr. (General Electric Research Lab., Schenectady, N. Y.). Trans. Am. Soc. Mech. Eng. 79, 1637-51(1957) Oct.

A summary of a co-operative research investigation extending earlier work on the thermal-stress-fatigue resistance of AISI Type 347 stainless steel is made. The investigation was to provide additional qualitative experimental support of the concept of fatigue design based on an allowable stress range which is embodied in the ASA-B31.1 Code Rules for Piping Flexibility Design. Two specific objectives were established, together with the findings of this research: (a) Investigation of the effect of cycling which produces tensile rather than compressive stress under the hot condition. It was found that there was no significant difference. (b) Investigation of the effect of reducing the net mechanical strain range for a given temperature range to a point approaching the design strains for a piping system. While the temperature range was held constant, the trend of reducing the net mechanical strain range was to increase the number of cycles to failure similar to that obtained when the net mechanical strain range was reduced by lowering the temperature range under full constraint. In addition, for the same mechanical strain range, widening the temperature range decreased the number of cycles to failure. (auth)

318

MEASUREMENTS OF THE MELTING POINTS OF ALUMINUM AND COPPER AT PRESSURES UP TO 18000 kg/cm^2. M. G. Gonikberg, G. P. Shakhovshoĭ, and V. P. Butuzov (Inst. of Crystallography, Acad. of Sciences, U.S.S.R.). Zhur. Fiz. Khim. 31, 1839-42(1957) Aug. (In Russian)

Determination of Al and Cu melting points in an inert gas showed that within the limits of experimental error the melting points of the metals rise linearly with the pressure. The applicability of Simon's equation to the melting points of metals at high pressure is discussed. (tr-auth)

Tracer Applications

319

USE OF RADIOISOTOPES IN HYDROLOGY. I. METHOD FOR THE DETERMINATION OF FLOW AND DISCHARGE OF WATER STREAMS. Heribert Moser and Ferdinand Neumaier. Atomkern Energie 2, 26-9(1957) Jan. (In German)

A procedure for measurement of flow and discharge in streams by concentration measurement in water charged with a tracer (radioactive iodine) is described. This procedure might serve to clear up some problems of hydrology, the water table, and hydrotechnics. (tr-auth)

PHYSICS

320 AECU-3517

RAND Corp., Santa Monica, Calif.

POINT SOURCE EXPLOSION IN AIR. Harold L. Brode. Dec. 3, 1956. 85p. Contract AT(29-1)-1477. (RM-1824-AEC; AD-133030). $13.80(ph OTS); $4.80(mf OTS).

Using a high speed JOHNNIAC computer and a program which allows the solution of the partial differential equations governing hydrodynamic motion in spherical geometry, the problem of the blast wave from a point source in air was carried out. The methods are described and the equation of state for air is given. The results of the particular solution for a point source is covered, giving shock values of pressure, density, particle velocity, temperature and dynamic pressure as functions of the shock radius and of the peak overpressure. The time histories of the same variables are given for a number of distances from the source, as well as values of the durations of positive phases and impulses from overpressure and from dynamic pressure. (auth)

321 ANL-5792

Argonne National Lab., Lemont, Ill.

BIBLIOGRAPHY ON VARIOUS TOPICS PERTAINING TO BLAST EFFECTS. J. C. Heap. Oct. 1957. 23p. Contract W-31-109-eng-38. $0.75(OTS).

The references of this résumé have been obtained largely from a card index compiled at Argonne National Lab. The source of information has been arranged in chronological order according to subject matter, then document number. (auth)

322 CEA-651

France. Commissariat à l'Énergie Atomique, Paris.

EMPILEMENT POUR LE CONTROLE DE L'ENRICHISSEMENT DE L'URANIUM (E.C.E.U.). (An Experimental Stack for the Control of Uranium Enrichment.) B. Bailly du Bois, V. Raievski, and O. Tretiakoff. Mar. 21, 1957. 12p.

An apparatus is described for controlling the enrichment of the U in a fuel element at all stages in its fabrication. The apparatus consists of a stack of graphite surrounded by Cd, in which a thermal neutron density is maintained by a Ra–Be source placed in the stack. The enrichment is obtained by comparing the counting rate of the element to be controlled with that of a geometrically similar standard element, previously calibrated. (auth)

323 NP-6441

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 26. Oct. 15, 1957. 33p. Contract Nonr-1841(34).

Studies are reported on: the representation of the exchange terms in Fock's equation by a quasi-potential; atomic wave functions for Fe; electronic wave functions for HF; energy bands in K; and computation of two center integrals. (For preceding period see NP-6352.) (T.R.H.)

324 NP-6453

Columbia Univ., New York. Columbia Radiation Lab.

RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 7 [for] June 16, 1957 through September 15, 1957. P. Kusch. Sept. 15, 1957. 48p. Contract DA-36-039-SC-64630. (CU-9-57-SC-64630-Phys.).

Six XHI harmonic generators were tested during the past quarter. Second harmonic power output was increased to 34 kw at an efficiency of 8.2%. It was also demonstrated that second harmonic output power is a maximum for magnetic field strengths corresponding to the "valley of efficiency" near $\lambda_1 B = 12{,}200$ gauss-cm. A XHI third harmonic generator has produced 1.2 kw harmonic power. Some further measurements of master beam sources were made. It has been found that low Q (about 100) resonances are occurring in the experimental vessel. These cause too large an absolute value of absorption and in addition cause the observed non-reproducibility of results if the magnetron wavelength changes slightly. The rotational transition $J = 2 \leftarrow 1$ of the molecule ClCN was observed. A new experiment was undertaken to measure the hyperfine structure of the nitrogen atom. Preliminary investigation of possible atomic sources are underway. Experimental work on the hyperfine structure of He^3 was successfully completed. The final value is $\Delta\nu(He^{3+}, 2^2S_{1/2}) = 1083.35499 \pm .00020$ Mc/sec. Construction of the apparatus for the production and detection of a beam of metastable Li^{++} ions

was completed. Operation of this apparatus was prevented by the leakage of charged particles into the detector and by ion scattering at the back surface of the ion mirror. (For preceding period see NP-6389.) (auth)

325 SCTM-275-57(14)

Sandia Corp., Albuquerque, N. Mex.

THEORY OF END-LOADED MONOPOLE. C. W. Harrison, Jr. Oct. 8, 1957. 26p. Contract AT(29-1)-789. $4.80 (ph OTS); $2.70(mf OTS).

The impedance of an antenna consisting of two parallel cylindrical conductors of radius a_1 and a_2 connected to a complex load impedance Z_L at their outer extremities is derived. The wires are of half-length h; the spacing between them is b; the conductor of radius a_1 is center-driven by an external voltage V_0. It is shown that if the parameters h and b are fixed, the input impedance may be varied over wide limits by appropriate adjustment of the ratio a_1/a_2 and Z_L. Large varieties of end-loaded folded-wire configurations are amenable to analysis by a systematic application of the method of solution described for the two-wire structure. The impedance of an end-loaded monopole oriented vertically with respect to an infinite perfectly conducting plane is one half of the impedance of the structure described. Ancillary tables, having universal application in this field, are supplied to permit rapid numerical studies of the admittance qualities of folded-wire structures. (auth)

326 NACA-TM-1405

STEADY NUCLEAR COMBUSTION IN ROCKETS. (Stationäre Kernverbrennung in Raketen.) E. Sänger. Translated by S. Reiss from Astronaut. Acta 1, 61-88(1955). 39p.

Astrophysical theory is applied to study possibilities for thermonuclear reactions to be used as an energy source for the propulsion of atomic rockets, photon rockets, turbojets, and ram jets. Results indicate maximum heat production at 10^8 °K for the hydrogen isotopes. For chamber pressures of 100 atm the energy release 10^4 kcal/(cu m)(sec) is comparable to that of the chemical fuels. The effect of burnup time and of the degree of complete ionization on the balance between energy release and energy radiated is determined. (NACA abst.)

327

TWO-PHASE, STEAM-WATER CRITICAL FLOW. H. S. Isbin, J. E. Moy, and A. J. R. Da Cruz (Univ. of Minnesota, Minneapolis). A.I.Ch.E. Journal 3, 361-5(1957) Sept.

Two-phase critical flow of steam-water mixtures has been investigated oyer a pressure range from 4 to 43 lb./sq. in. abs. and a quality range from saturated vapor to 1% (weight) vapor. Discharges were measured from ¼-, ½-, ¾-, and 1-in. pipes and from annuli of intermediate cross-sectional areas. The experimental mass flow rates are always greater than the values calculated on the basis of a homogeneous flow model. Several empirical methods for correlating the data were determined, and comparisons are presented of the predictions of several analytical flow models. (auth)

328

ON THE CALCULATION OF FIRST EXCITATION LEVELS IN MAGNETIC SUBSTANCES. Pierre-Gilles de Gennes. Compt. rend. 243, 1730-2(1956) Nov. 26. (In French)

The spin wave spectrum can be calculated from measurements of elastic scattering of neutrons, as can also the torsional energy of a Bloch domaine. (auth)

329

NEUTRON DIFFRACTION STUDY AT 4.2°K OF THE ANTIFERROMAGNETIC STRUCTURE OF $FeCl_2$. André Herpin and Pierre Mériel. Compt. rend. 245, 650-3(1957) Aug. 5. (In French)

A neutron diffraction study of the magnetic structure of $FeCl_2$ and its modifications in the presence of a field is reported. (T.R.H.)

330

MEASUREMENT OF CHAPMAN-JOUGUET PRESSURE FOR EXPLOSIVES. W. E. Deal (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 796-800(1957) Sept.

The Chapman-Jouguet pressures of RDX, TNT, 64/36 Composition B, and 77/23 Cyclotol have been measured by determining initial free-surface velocity as a function of thickness for 24ST aluminum plates in contact with the detonating explosive. An optical technique is described for the measurement of the velocities. The pressures determined for RDX, TNT, 64/36 Composition B, and 77/23 Cyclotol are 338, 189, 292, and 313 kilobars, respectively. (auth)

331

COEFFICIENT OF EXPANSION OF POLONIUM. R. E. Brocklehurst, J. M. Goode, and L. F. Vassamillet (Mound Lab., Miamisburg, Ohio). J. Chem. Phys. 27, 985(1957) Oct.

332

CYCLOTRON RESONANCE IN BISMUTH. J. E. Aubrey and R. G. Chambers (Royal Society Mond Lab., Cambridge). Phys. and Chem. of Solids 3, 128-32(1957).

Azbel' and Kaner have suggested that the microwave surface impedance of a metal at low temperatures should show periodic variations with magnetic field, if the field is applied parallel to the surface. Preliminary observations are reported on this effect in Bi crystals of three different orientations, and the results are shown to agree reasonably well with those expected on the basis of Shoenberg's measurements of the De Haas–Van Alphen effect. A model is proposed for the Fermi surface in Bi which appears to be consistent with most of the available experimental evidence on this metal. (auth)

333

HALL EFFECT IN TITANIUM, VANADIUM, CHROMIUM, AND MANGANESE. Simon Foner (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 107, 1513-16(1957) Sept. 15.

The Hall effect in Ti, V, Cr, and Mn has been measured at room temperature with fields up to 30 kilooersteds. The Hall constant was positive for all of these elements. The effect is extremely small in Ti and apparently sensitive to small amounts of impurities. The results for these transition elements indicate that electrical conduction is predominantly due to hole conduction. (auth)

334

ELECTRONIC POLARIZABILITIES OF IONS. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y. and Univ. of Chicago, Ill.). Phys. Rev. 107, 1565-9(1957) Sept. 15.

The dipole polarizability α_d and the quadrupole polarizability α_q have been calculated for several ions by solving the Schrödinger equation satisfied by the first-order perturbation of the wave functions of the electrons of the core. The results for α_d of the helium-like ions are in good agreement with those obtained previously by an analytic method. The calculated quadrupole polarizability α_q of the alkali ions increases very rapidly with increasing Z, from 0.056 A^5 for Na^+ to 7.80 A^5 for Cs^+. (auth)

335

ENERGY DEPENDENCE OF THE FLUORESENCE OF POLYCRYSTALLINE LUMINOUS MATERIAL BY EXCITATION WITH ELECTRONS AND ROENTGEN RAYS. D. Messner. Z. Physik 147, 24-42(1957). (In German)

Aerosols

336 PTP-498

Gt. Brit. Chemical Defence Experimental Establishment, Porton, Wilts, England.

PRELIMINARY STUDIES OF THE DISTRIBUTION OF PARTICLES AT MEDIUM RANGE FROM A GROUND LEVEL POINT SOURCE. F. Pasquill. Aug. 12, 1955. 24p.

The results of a small number of exploratory experiments to observe the 3-dimensional distribution of airborne particles at distances up to 40 miles from a ground level source of about 1 hour duration are summarized and briefly discussed. For the most part the conditions were moderately unstable up to overhead inversions at heights ranging from 2600 to 7500 feet. Extreme cloud widths ranged from about 40° (angle subtended at source) at 5 miles distance to about 20° at 40 miles. The direction and speed of travel of the clouds were on the average closely in accordance with the measured vector mean wind over the first 2000 or 3000 feet. In individual experiments the deviations therefrom were ±5° in direction and ±4 mph in speed. In the conditions mainly encountered vertical diffusion in the layer below the inversion appeared to be an order of magnitude more rapid than in the lower atmosphere in neutral conditions of stability. The evidence for the effect of an overhead inversion in limiting vertical diffusion is indecisive. The general difficulties encountered in obtaining and interpreting the distribution downwind of a source of short duration emphasize the point that it would be more profitable to use a longer duration source and to concentrate the sampling operations on the relatively "steady" central section of the cloud. (auth)

Astrophysics

337

DEPTH VARIATION OF TRITIUM AND ARGON-37 PRODUCED BY HIGH-ENERGY PROTONS IN IRON. E. L. Fireman (Smithsonian Astrophysical Observatory, Cambridge, Mass.) and J. Zähringer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 1695-8(1957) Sept. 15.

The H^3 produced by 0.16-, 1.0-, 3.0-, and 6.2-Bev protons and the Ar^{37} by 0.16-, 1.0-, and 6.2-Bev protons in long iron targets is measured as a function of depth. The maximum effective H^3 cross section is 7.2 mb at 0.16 Bev, 60 mb at 1.0 Bev, 100 mb at 3.0 Bev, and 130 mb at 6.2 Bev. The maximum effective Ar^{37} cross section is 0.19 mb at 0.16 Bev, 4.7 mb at 1.0 Bev, and 6.7 mb at 6.2 Bev. The depth variation of these isotopes is very energy-dependent. At the higher energies a slight transition effect occurs. At the lower energies there is an exponential decrease with depth. The comparison of these measurements with the depth variation of He^3 in the Carbo meteorite shows that the cosmic rays that produced the He^3 in this material were very similar to the protons with 6-Bev energy. The H^3 to Ar^{37} ratio is not very energy- or depth-dependent. The ratio is 15 at 1 Bev and 20 at 6.2 Bev. However, for 0.16-Bev protons the H^3 to Ar^{37} ratio increases from 40 to 1000 in 4-cm depth. The H^3 to Ar^{37} ratio is compared with the He^3 to Ar^{36} ratio in four iron meteorites. These are comparable to a remarkable extent with the Bev proton results. The small variation of the He^3 to Ar^{36} ratio in meteorites is related to the fact that the H^3 to Ar^{37} ratio is not very energy- or depth-sensitive for protons in the Bev range; however, the He^3 to Ar^{36} ratio also favors the 6-Bev energy. (auth)

Cosmic Radiation

338

DETERMINATION OF THE FLUX OF THE PRIMARY COSMIC PARTICLES AT 31°N LATITUDE. K. I. Alekseeva, S. I. Brikker et. al. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 115, 71-4(1957) July 1. (In Russian)

The intensity of the hard component in the stratosphere was measured during the determination of the cross section for the inelastic interaction of cosmic ray particles with carbon and hydrogen nuclei. The measurements permitted the determination of the flux of the primary particles at the atmosphere boundary. Description are given of the instruments used for the measurements of the inelastic interaction and of the results obtained in measuring the intensity of the hard component; however, the results of the cross section measurements will be published later. The absorption range of the charged particles of the shower forming component in the stratosphere at the 31°N latitude was found to be 150 to 170 g/cm^2. (R.V.J.)

339

THE CROSS SECTION OF INELASTIC INTERACTION OF PROTONS OF MORE THAN 7 BEV KINETIC ENERGY WITH NUCLEI OF CARBON ATOMS. K. I. Alekseeva and N. L. Grigorov. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 115, 259-62(1957) July 11. (In Russian)

The cross section of proton inelastic interaction with carbon nuclei was measured at geomagnetic latitude 31°N in the stratosphere. Experimental data obtained at the <20 km elevation was used in the cross section determination of proton flux with 80% of protons of over 7 Bev kinetic energy (¾ of them with average energy ~ 12 Bev). Flux depression in the shower forming component during its passage through graphite and the direct observation of the inelastic interactions in the graphite filter (of the number of meson showers in graphite) were used in the investigation. The cross section measured for the inelastic interaction of ~ 12 Bev protons with carbon nuclei coincides with the geometric cross section of the carbon nucleus, within the limits of experimental error. (R.V.J.)

340

ENERGY SPECTRUM OF THE SOFT COMPONENT NEAR SEA LEVEL. Hugh Carmichael (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Phys. Rev. 107, 1401-9(1957) Sept. 1.

An analysis of the transition curves of Carmichael and Steljes has been carried out to yield the transition curves in lead of ion-chamber bursts produced by cascades initiated by the electrons and photons of the soft component incident from the atmosphere. From the rates at the maxima of these transition curves, the absolute omnidirectional integral energy spectrum of the electrons and photons of the soft component at sea level, in the energy range from about 100 Mev to 100 Bev, is deduced. Incident electrons and photons associated with extensive air showers, as identified by coincidences with a nearby larger ion chamber, are excluded. An additional single experimental point on the integral spectrum (8.4×10^{-3} per sphere of unit area per sec) is obtained from the observed rate of electrons of all energies greater than 1 Mev which intersect the unshielded ion chamber. Since a quantitative relation from electromagnetic cascade theory is made use of in the derivation of the energy spectrum, and since this relation is at present uncertain for lead in the energy range involved, the possible error of the flux in the energy spectrum (±100%) is much larger than that of the observed rates of occurrence of bursts (±5%). In this respect the spectrum is preliminary

only. In the energy range below 400 Mev the integral spectrum is in agreement with previous absolute measurements; below 2 Bev it is in conformity with a previous relative measurement; from 1.6 Bev to 100 Bev, where there are no previous determinations, it obeys a power law of exponent −2.00 and the rate for 1.6 Bev is 2.4×10^{-8} per sphere of unit area per sec. (auth)

341

MEAN FREE PATH OF HIGH-ENERGY NUCLEONS IN THE ATMOSPHERE. Leonilda Altman Farrow (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 1687-94(1957) Sept. 15.

An altitude-variation experiment to determine the absorption mean free path in the atmosphere of high-energy nucleons of the cosmic radiation has been performed using a large ionization chamber and associated counter trays. It is estimated that the nucleons studied in this experiment range in energy from 200 to 2000 Bev, which is a higher energy region than has been investigated previously in similar experiments. The absorption mean free path for protons is found to be 125 ± 9 g/cm^2 and for neutrons 105 ± 8 g/cm^2, and the charged-to-neutral ratio is 1.54 ± 0.15. These values are in good agreement with previous altitude variation experiments. There seems to be no change in the mean free path with energy. These results are compared with the calculations of Olbert and Stora, who consider the Fermi model for nuclear interactions with the assumption of no nucleon-antinucleon pair production and partial elasticity for the collision. It is seen that the experimental values fit fairly well into this picture. Evidence is presented for the presence of high-energy nucleons near the cores of air showers, in agreement with previous work. If a power law is fitted to the density spectrum of air showers associated with nucleons, a crude value of 0.64 may be found for the exponent. Considering the scarcity of the data on which the evaluation of this particular quantity is based, the result may be in reasonably good agreement with the only previous determination which is equal to 0.5. (auth)

Crystallography and Crystal Structure

342 NP-6451

Eagle-Picher Research Labs. Mining and Smelting Div., Miami, Okla.

RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES. Quarterly Report No. 1 for period of April 17, 1957 to July 17, 1957. W. E. Medcalf, K. E. Bean, and J. E. Powderly. 57p. DA Project No. 3-99-00-100. Contract DA-36-039-SC-73270.

Single crystals of cadmium sulfide 10 mm × 10 mm × 25 mm were prepared by sublimation-recrystallization of cadmium sulfide with crystal growth occurring on a polished clear quartz plate. Dark resistivities of the crystals ranged from 25 thousand ohm-centimeters to 140 million ohm-centimeters. The crystals were prepared for studies of gamma ray detection with 50 volts d-c applied across the electrode of the crystals. A change in current reading under irradiation with gamma rays was observed. Data are included on the resistivity of the crystals before and after doping with In_2S_3. (C.H.)

343

NUCLEAR MAGNETIC RESONANCE, RADIATION DAMAGE, AND RIGIDITY IN BRANCHED POLYETHYLENE AS A FUNCTION OF TEMPERATURE. N. Fuschillo and J. A. Sauer (Pennsylvania State Univ., University Park). J. Appl. Phys. 28, 1073-81(1957) Oct.

Molecular motions and microstructure are studied as a function of irradiation damage and temperature in branched polyethylene. The methods of proton magnetic resonance, specific volume and density percent crystallinity, mechanical rigidity and loss, and x-ray determined crystallinities are employed. The samples were subjected to irradiation doses ranging from 0 to 8.3×10^{18} nvt in the Brookhaven reactor. Significant changes in the proton resonance line shape at 295°K occur for an irradiation of 0.3×10^{18} nvt. Second moments and intensity ratios indicate that the first effect of irradiation on the line shape can be interpreted as due to the destruction of crystallinity or order. This effect however is offset at higher doses by the restrictive influence of radiation induced crosslinks on molecular chain motion. Estimates of the percent crosslinking aid in the interpretation of the temperature variation of proton resonance line shapes and allow some estimate to be made of the lengths of chain associated with a given type of molecular motion. Activation energies are calculated from NMR and mechanical loss data for these molecular motions. With increasing temperature the proton resonance and mechanical properties are associated first with rotational oscillations, over energy barriers, of short segments (of the order four methylene groups in length) of a chain (activation energy ~6 kcal/mole) and also with the γ peak of the mechanical loss data. At temperatures exceeding the "glass transition temperature" the molecular movements are also described by neo-Brownian diffusional motions involving chain lengths of about 10 methylene groups (activation energy ~12 kcal/mole). These latter "neo-Brownian" motions are associated to some extent with the β peak of the mechanical loss data and probably also involve some branch point motion. The majority of the motion occurs principally in the amorphous regions of the branched polyethylene until temperatures above 290°K are reached and the microstructure begins to change due to the melting of crystallites. The intensity ratio for the complex line shape exhibited by polyethylene at temperatures greater than 200°K are associated with the high-frequency rigidity of the sample. (auth)

344

THE CRYSTAL STRUCTURES OF MANGANESE AND THE ACTINIDE ELEMENTS. L. E. Orgel (Univ. of Cambridge). Phys. and Chem. of Solids 3, 50-2(1957).

The crystal structures of manganese and the actinide elements are discussed from the point of view of a recent theory of the electronic structure of body-centered cubic metals. It is shown that the existence of complex structures may be related to the possibility of Jahn-Teller distortions occurring in the body-centered cubic lattice. (auth)

345

CYCLOTRON RESONANCE OVER A WIDE TEMPERATURE RANGE. D. M. S. Bagguley and D. J. Taylor (Clarendon Lab., Oxford) and J. A. Powell (Marconi Research Lab., Great Baddow, Chelmsford, Essex). Proc. Phys. Soc. (London) A70, 759-62(1957) Oct.

By doping the semiconductor with transition group metals such as Fe, Co, or Au, localized states well into the forbidden band may be introduced and, if the carriers are derived from these levels, their number can be maintained reasonably small at temperatures as high as 90°K. Using this technique, cyclotron resonance from hole carriers in Ge at temperatures above 90°K with microwave radiation of 8.8 mm wavelength were observed. Results obtained from Ge doped with Au are reported over a temperature range from about 4 to 90°K. (M.H.R.)

346

COLOUR CENTERS AND X RAY SPECTRA OF POTASSIUM HALIDE CRYSTALS. Amar Nath Nigam (Univ. of Allahabad, India). Z. Physik 147, 264-70(1957).

Possible correlations of the energy levels arising due to color centers in a potassium halide crystal with the x-ray

absorptions fine structure of potassium ion are discussed. Influence of the inner ionization on the activation energy of the ions and on the potential surrounding them has been estimated using approximate equations. (auth)

347

X RAY STUDY OF DISTORTIONS IN THE CRYSTAL LATTICE OF Al DEFORMED AT THE TEMPERATURE OF BOILING NITROGEN. S. O. Tsobkallo and B. I. Smirnov (Kalinin Leningrad Polytech. Inst.). Zhur. Tekh. Fiz. 27, 1912-14(1957) Aug. (In Russian)

Electrical Discharge

348 AERE-GP/R-2265

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MEASUREMENT OF ELECTRON TEMPERATURES BY MICROWAVE METHODS. A. N. Dellis. May 1957. 16p.

A discussion is given of the emission of electromagnetic radiation by a gas discharge plasma at frequencies well above the electron collision frequency. It is shown that this emission is considerably enhanced just above the critical frequency. Some experiments are briefly described in which this radiation was measured in the microwave region and the result used to evaluate the electron temperature of the plasma. (auth)

349 AERE-T/R-2264

Gt. Brit. Atomic EnergyResearch Establishment, Harwell, Berks, England.

THE INFLUENCE OF CONDUCTING WALLS ON THE WRIGGLING GAS DISCHARGE. PART II. WALLS OF FINITE CONDUCTIVITY. S. J. Roberts and R. J. Tayler. July 1957. 29p.

A very simplified model of a wriggling gas discharge is taken in order to obtain some knowledge of the influence on it of walls of finite conductivity. For this model, in which the motion of the discharge is controlled by unspecified forces, the field due to eddy currents can be split into non-harmonic and harmonic parts; the former gradually decays to zero, while the latter which is continually regenerated by the motion of the discharge approaches an equilibrium value. For walls of Cu or Al and for oscillation frequencies and apparatus dimensions in which we are mainly interested, the difference between the initial and equilibrium values of the harmonic forces is not very great; in addition the non-harmonic forces only decay appreciably in times of the order of seconds. Because of the very simplified nature of the problem studied these results must not be taken too literally when considering the actual wriggling discharge. (auth)

350

PLASMA OSCILLATIONS IN A STEADY MAGNETIC FIELD: CIRCULARLY POLARIZED ELECTROMAGNETIC MODES. Trilochan Pradhan (Univ. of Chicago, Ill.). Phys. Rev. 107, 1222-7(1957) Sept. 1.

Van Kampen's method of treating the singularity which occurs in the solution of Boltzmann's equation for plasma oscillations is applied to the corresponding problem in the presence of a uniform external magnetic field. The propagation of electromagnetic waves in the direction of the field is considered in this paper. Expressions for the refractive index and damping of the waves have been obtained which show striking departures from the Appleton-Hartree electromagneto-ionic theory near the cyclotron resonance frequency. (auth)

Electrons

351 ORNL-2365(Suppl.)

Oak Ridge National Lab., Tenn.

ON THE RELATIONSHIP BETWEEN THE CHARGE OF AN ION AND ITS VELOCITY. Supplement. Jacob Neufeld. Oct. 28, 1957. 88p. Contract W-7405-eng-26. $13.80 (ph OTS); $4.80(mf OTS).

A supplement was prepared with the purpose of assisting in further work involving studies of charge exchange collisions. It contains a set of graphs showing the Lisitzin and Mayer curves and data of Finkelnburg for a number of elements. These graphs represent the relationship between the outermost orbital velocity v of an ion and the corresponding binding charge Z^* for all elements except Li, N, O, F, Ne, Sr, and Xe. The electron velocities are calculated assuming that each electron is in a central Coulomb field characterized by the corresponding binding charge. These curves represent an interpolation of the data of Lisitzin, Mayer, and Finkelnburg in which the discrete points representing the binding energies and velocities of neighboring orbits have been connected by straight line segments. Thus each of these curves represents the relationship between the velocity of the ion and the corresponding charge when the following two assumptions are satisfied: (a) a stripping of the outermost orbit occurs only when the velocity of the ion V exceeds by a very small amount the velocity v_n of the orbit and as a result of the stripping the charge of the ion is equal to the binding charge corresponding to the orbital electron of velocity v_n; (b) the charge of the ion Z^* is a linear function of its velocity v over a short range bounded by the velocities of two neighboring electron orbits. (C.H.)

352

POLARIZATION OF ELECTRONS EMITTED BY S^{35}. Hélène Langevin-Joliot and Nadine Marty. Compt. rend. 245, 670-2(1957) Aug. 5. (In French)

The polarization of 128 kev beta rays (v/c = 0.6) emitted by an S^{35} source (transition $\Delta J = o$, not permissible) was found to be equal to -0.38 ± 0.1. Different effects can diminish the polarization, notably the thickness of the source. (tr-auth)

353

PAIR PRODUCTION BY FAST PROTONS. W. E. Stephens and H. H. Staub. Helv. Phys. Acta 30, 260-1(1957). (In German)

Using the equation of Heitler and Nordheim for protons of 1.5 Mev on tantalum, the effective cross section for pair production was calculated to be approximately 1.5×10^{-30} cm^2. After corrections, the experimentally determined cross section was found to be less than 2×10^{-32} cm^2. (M.H.R.)

354

MEASUREMENT OF MEAN FREE PATH FOR DIRECT PRODUCTION OF ELECTRON PAIRS BY HIGH ENERGY ELECTRONS. II. CORRECTION FOR FALSE TRIDENTS. M. Gailloud, R. Weill, and Ph. Rosselet. Helv. Phys. Acta 30, 280-2(1957). (In French)

A new method to eliminate the unresolvable bremsstrahlung pairs is described. Thus the mean free path for direct pair production by electrons can be determined more precisely. Disagreement between measured and Bhabha's theoretical values grows with energy. (auth)

355

DETECTION OF ELECTRON POLARIZATION BY DOUBLE SCATTERING. A. de-Shalit, S. Kuperman, H. J. Lipkin, and T. Rothem (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 107, 1459-60(1957) Sept. 1.

356
CIRCULAR POLARIZATION OF INTERNAL BREMSSTRAHLUNG. A. Pytte (Harvard Univ., Cambridge Mass.). Phys. Rev. 107, 1681-5(1957) Sept. 15.

A calculation is made of the circular polarization of the internal bremsstrahlung is allowed β decay with the most general β interaction. The polarization is found to rise from zero at the low-energy end of the spectrum to a maximum value at the high-energy end. This maximum value depends critically on the relative magnitudes of the coupling constants in the β interaction. With the two-component neutrino theory and only the scalar and tensor interactions present, the polarization is complete at the high-energy end of the spectrum. Plots have been made, with this β coupling, of the Born approximation result for the circular polarization as a function of photon energy for S^{35} and P^{32}. The effects of the nuclear Coulomb field on the γ-ray spectrum and polarization are discussed. (auth)

357
COULOMB SCATTERING OF POLARIZED ELECTRONS. Feza Gürsey (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 1734-5(1957) Sept. 15.

The amount of longitudinal depolarization, L, and the asymmetry ratio, A, for a β beam are expressed exactly in terms of F and G (the complex functions introduced by Mott). Approximate analytical expressions for L and A (corresponding to the second-order Born approximation) are also derived. The results are applied to a double-scattering experiment performed by de-Shalit. (M.H.R.)

Gases

358 AERE-GP/M-199
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE TRANSMISSION OF STRONG SHOCK WAVES THROUGH MAGNETIC FIELDS. K. Dolder. Apr. 10, 1957. 16p.

Existing theoretical and experimental investigations of the passage of shock waves through magnetic fields are reviewed. Two procedures by which the strength of hydromagnetic interaction can be estimated are then described. In the first method equations governing hydromagnetic flow are set down and dimensionless parameters, which determine the strength of this interaction, are obtained. Values of these parameters are calculated for conditions likely to be encountered in our shock tubes. The second method is based upon more detailed calculations given by Lin and affords not only a rough quantitative guide but also a useful qualitative account of the flow pattern produced by the passage of a shock through an impressed field. (auth)

359 AFCRC-TR-56-205
Air Force Cambridge Research Center, Bedford, Mass.
A REVIEW OF CHARGE TRANSFER PROCESSES IN GASES. Geophysical Research Papers No. 48. S. N. Ghosh, W. F. Sheridan, J. A. Dillon, Jr., and H. D. Edwards. July 1955. 28p.

A review is given of the nature and importance of the charge transfer process ($A^+ + B \rightarrow A + B^+$) particularly with regard to its role in certain chemical and physical processes. Experimental techniques for determining the charge transfer cross sections are discussed, with special reference to the recent method whereby the number of ions due to charge transfer is directly compared with that of the primary beam. This technique has been utilized by the authors. The cross sections obtained from experimental data in the energy range 50 to 800 ev are discussed in some detail. The data obtained by other investigators from thermal energies to 40 kev are also presented. It is shown that the adiabatic theory (Massey) satisfactorily explains the charge transfer reaction for a large number of simple atomic and molecular cases. However, certain very simple cases cannot be explained in terms of this theory even by assuming excited states or dissociation of the molecules by collision. (auth)

360 HE-150-119
California. Univ., Berkeley. Inst. of Engineering Research.
A NEW METHOD OF FLOW VISUALIZATION FOR LOW DENSITY WIND TUNNELS. R. A. Evans. Jan. 11, 1954. 91p. Contract AF-33(038)-8896.

The absorption by O_2 of radiation in the wavelength region 1400 to 1500A is utilized and is referred to as the O_2 absorption method. It was developed for use in the low-density supersonic continuous flow wind tunnels at Berkeley because the conventional methods (shadowgraph, schlieren, and interferometer) were predicted to have inadequate sensitivity at the unusually low densities in the test section. A Xe discharge is used for the source of radiation, its 1470A resonance line being isolated by a CaF_2 vacuum monochromator. A 26 mm diameter beam of parallel radiation is passed through the test section where it is absorbed more or less depending on the O_2 density along the radiation path. The center of the test section is then focused by a CaF_2 vacuum camera on an ultraviolet sensitive photographic plate. Pictures of shock waves from cylinders $\frac{1}{8}$ and $\frac{1}{4}$ in. diameter and from a 60°, $\frac{3}{8}$ in. wedge were obtained with exposure times of about 4 min. Further development of a stronger source is expected to reduce the exposure time appreciably. This O_2 absorption method is shown to be suitable for general wind tunnel work where the absolute pressures are below about 1 mm Hg. A simplified analysis of five flow visualization methods as applied to a two-dimensional circular shock wave is presented, and the minimum detectable density difference is estimated for each. (auth)

361 HE-150-130
California. Univ., Berkeley. Inst. of Engineering Research.
VISUALIZATION OF LOW-DENSITY FLOWS BY MEANS OF OXYGEN ABSORPTION OF ULTRAVIOLET RADIATION. Pauline M. Sherman. Aug. 23, 1955. 56p. Contract AF-33(038)-8896.

A vacuum spectrograph-monochromator-camera with a 1470 A radiation source was adapted for installation in the low pressure wind tunnel. Shock wave photographs were taken of several flow configurations. The shock waves were those formed by flow over a sphere, a cone, wedges, and a cylinder with axis aligned parallel to the direction of the flow. All photographs were taken at a free stream Mach number of ~3.9, with a uniform jet area ~two in. in diameter at the nozzle exit plane, and a tunnel test chamber static pressure of ~114 μ Hg. The photographs obtained were studied by means of a microphotometer. An analytical method of determining stream density, from the absorption of radiation in an axially-symmetric flow, is discussed. A sample density calculation is presented. (auth)

362
A THEORY OF GAS FLOW THROUGH A POROUS BODY IN THE VICINITY OF THE KNUDSEN REGION. PSEUDO-MOLECULAR FLOW. B. V. Deryagin and S. P. Bakranov. (Inst. of Phys. Khim, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 115, 267-70(1957) July 11. (In Russian)

363
RARE GASES FROM THE NUEVO LAREDO STONE METE-

ORITE. J. H. Reynolds and J. I. Lipson (Univ. of California, Berkeley). Geochim. et Cosmochim. Acta 12, 330-6 (1957).

The isotopic composition of He, Ne, Ar, and Xe gases from the Nuevo Laredo Stone meteorite has been measured. The concentrations of these gases have also been determined by isotope dilution, except in the case of Xe, where a less accurate method was employed. Radiogenic He^4 and Ar^{40} are present. Cosmogenic He, Ne, and Ar are present. The Xe found, which may be entirely due to contamination, was of normal isotopic composition, a fact which has a bearing on the time-interval between nucleogenesis and the formation of meteorites. The K-A age of the stone lies between 3.1 and 3.6×10^9 years, which establishes independently of previously published lead-isotope data for the stone that it is ancient, but suggests that there has been some loss of radiogenic Ar. Most of the radiogenic He^4 has escaped, if a published value of the lead concentration is correct. The cosmogenic gases have isotopic compositions in general agreement with earlier work, but are present in lower concentrations, particularly so with He^3. This suggests that the stone has been severely heated late in its history. (auth)

364

HIGHER APPROXIMATIONS FOR THE TRANSPORT PROPERTIES OF BINARY GAS MIXTURES. II. APPLICATIONS. Edward A. Mason (Univ. of Maryland, College Park). J. Chem. Phys. 27, 782-90(1957) Sept.

Detailed numerical calculations are used to test the convergence of the higher approximations for the diffusion coefficient and thermal diffusion factor. The results show Kihara's second approximation to be the best to use and of sufficient accuracy, except for the thermal diffusion factor of mixtures with a heavy component in excess. For such a mixture both the Chapman-Cowling and the Kihara approximations are unreliable, and a new method is proposed for this case. The thermal diffusion of hydrogen-carbon dioxide mixtures is taken to illustrate the possible large errors resulting from use of inaccurate the theoretical expressions. For precise work, the first approximations cannot in general be relied upon. (auth)

365

COOLANT CHOICE FOR THE V.H.T. REACTOR. Peter Fortescue (Atomic Energy Research Establishment, Harwell). Nuclear Power 2, 381-5(1957) Sept.

Calculations are shown which reveal the required properties in gas coolants for very high temperature solid homogeneous reactors. A number of gases are evaluated with respect to He but the final selection will depend also on compatibility, radiation stability, and mass transfer. (T.R.H.)

366

IONIZATION OF GASES BY RECOIL ATOMS. W. G. Stone and L. W. Cochran (Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 702-4(1957) Aug. 1.

The value of W, the average energy required to produce an ion pair, has been measured in several gases for the recoil atoms due to the alpha decay of ThC and ThC'. The method used compared proportional counter pulse heights from the first inch of alpha tracks with complete recoil tracks, auxiliary counters differentiating between the two by coincidence technique. For the recoils due to the decay of ThC, the following values of W (in ev per ion pair in the indicated gas) were obtained: CO_2, 102; C_3H_8, 99; C_2H_4, 104; He, 60; H_2, 81; CH_4, 111. The values for the decay of ThC' were found to be: CO_2, 99; C_3H_8, 92; C_2H_4, 90; He, 55; H_2, 68; CH_4, 96. (auth)

Instruments

367 AF-SAM-57-118

School of Aviation Medicine, Randolph AFB, Tex.

A FLASH-TRIGGERED ELECTRONIC TIMING AND MULTIPLE SHUTTER SYSTEM. Everett O. Richey. Apr. 17, 1957. 15p.

Equipment has been designed for exposing the eyes of rabbits to various intervals of an atomic flash with 1-msec accuracy. A crystal-controlled oscillator, bluebox, decade counter, electronic gate, and power amplifier are the units assembled to furnish trigger signals to a series of shutters. The equipment is described in detail and circuit diagrams are shown. (auth)

368 NP-6447

Navy Electronics Lab., San Diego, Calif.

NEL RELIABILITY BIBLIOGRAPHY. W. E. Jorgensen, I. G. Carlson, and C. G. Gros, comps. May 1956. 103p.

A bibliography of material on the general subject of electronic equipment reliability is being prepared by the Navy Electronics Lab. The first issue of this bibliography is presented in such a form that it may be kept up to date with periodic supplements. The general subject is broken down to ten subtopics; circuit design, components, electron tubes, failure analysis, general, human engineering, maintenance, mechanical design, systems, and testing. (D.E.B.)

369 SC-TM-231-57(14)

Sandia Corp., Albuquerque, N. Mex.

DIGITAL APPLICATIONS OF DIRECT-COUPLED TRANSISTORS. H. B. Barling. Sept. 10, 1957. 10p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

Direct-coupled transistor circuits found in digital computers, automated data systems, and other digital systems are discussed. Simplified design parameters and illustrative applications of such circuits are presented. (auth)

370 SCTM-259-57(14)

Sandia Corp., Albuquerque, N. Mex.

A SAMPLING INSPECTION UNIT FOR APAR. J. A. Arnold. Sept. 6, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

A breadboard of a simplified sampling inspection unit was constructed with a lot size range from 200 to 500, an AQL range from 0.035 to 4.0, and three inspection levels. The breadboard consists only of the reject indication circuit because the sample size determination portion is merely a repetition of this circuit. The breadboard requires −5 v d-c at 18 ma and 20 v d-c at 10 ma for the relay coil. A complete unit will require slightly higher current drain. This unit performs reliably. (auth)

371 UCRL-2208(Rev.)

California. Univ., Berkeley. Radiation Lab.

TIME QUANTIZATION IN A FEEDBACK SYSTEM. John F. Waddell and Harold D. Morris. July 1957. 88p. Contract W-7405-eng-48. $2.50(OTS).

Effects observed in a quantized time feedback system are discussed. The time-quantizer, the most important element in the system, is treated in detail as applying to any sort of sampling that can be approximated by a purely amplitude-sampling process. Following a general physical description of amplitude-sampling, the output spectrum of an amplitude-sampler of arbitrary pulse shape is derived and discussed. On the basis of the spectral analysis, a linear transfer function is developed which is applicable, with certain important limitations, to signals of all frequencies. The behavior of this transfer function is dis-

cussed, and several cases are distinguished. The problem of stability in a feedback loop is treated, with particular attention to the important type of oscillations that are here dubbed sampling oscillations. A general criterion for stability is developed, which includes all possible oscillations. Mathematical and physical interpretation of the stability criterion is provided, and a procedure is devised for the solution of practical problems. Experimental evidence is offered in support of the theoretical results, with good agreement. The theory is also checked by calculation of the behavior of a special case whose sampling oscillations are amenable to transient analysis; complete agreement between these calculations and the prediction of the theory is found to exist. (auth)

372 AEC-tr-3043
NEW ELECTRICAL INSTRUMENT FOR THE MEASUREMENT OF PRESSURE PULSATIONS. M. A. Markin. Translated from Izmeritelnaya Tekh., No. 5, 49-52(1956). 7p.

373 AEC-tr-3057
OPTICAL PYROMETERS—EOP-51M AND OP-48M FOR THE MEASUREMENT OF TEMPERATURES UP TO 6000°C. V. F. Finkelshtein, E. S. Shpigelman, and V. K. Kandyva. Translated from Izmeritelnaya Tekh., No. 5, 52-4(1956). 4p.

374
A SIMPLE PHOTOELECTRIC AMPLIFIER. H. Oswald and H. Straubel. Z. angew. Phys. 9, 438-42(1957) Sept. (In German)

A photoelectric amplifier is described, and the experimental characteristics of CdS photoresistance and its high sensitivity are considered. (tr-auth)

Isotopes

375 AERE-I/R-2216
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EXTRACTION, PURIFICATION AND INDUSTRIAL USES OF KRYPTON-85. E. J. Wilson, C. Evans, J. Chadwick, J. Eakins, and K. J. Taylor. Apr. 25, 1955. Decl. with amendments Dec. 28, 1956. 18p.

A method of purification, extraction, and measurement of Kr^{85} on the curie scale is described. Potential industrial uses of the isotope are also discussed. (auth)

376 JENER-52
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
A SIMPLE APPARATUS FOR PRODUCTION OF RADIOACTIVE IODINE-131 BY DRY DISTILLATION FROM PILE-IRRADIATED TELLURIUM DIOXIDE. Kjell Taugbøl and J. B. Dahl. Sept. 1957. 8p.

377 TID-3511
Technical Information Service Extension, AEC.
BIBLIOGRAPHY ON USES OF RADIOACTIVE AND STABLE ISOTOPES IN INDUSTRY. A List of Selected References. J. A. McCormick, comp. July 1957. 27p. $0.75(OTS).

This bibliography contains 455 references to articles from the open literature. An author index and literature reference source are also included. The main purpose is to indicate the information that is available on what has been and is being accomplished through the use of radioisotopes in industry. (auth)

378 AEC-tr-3061
YIELD OF FISSION PRODUCTS OF U^{235} IN THE RARE EARTH REGION. V. K. Gorshkov, R. N. Ivanov, G. N. Kukavadeze, and I. A. Reformatskii. Translated from Atomnaya Energ. III, 11-14(1957). 12p.

A description is given of results of measurements of the yields of the fission product of U^{235} using the integral mass spectrographic method, which makes it possible to simultaneously determine the concentration of several elements in their mixtures. Using the integral mass spectrographic method, measurements of the yields of La^{139}, Pr^{141}, Pm^{147}, and Pm^{149} are given for the first time. From these data the absorption cross sections for Pm^{147} and Sm^{147} are calculated, and the lower absorption cross section boundary for Sm^{149} is given. (auth)

379
DEVELOPMENT OF METHODS FOR THE PRODUCTION OF CERTAIN SHORT-LIVED RADIOISOTOPES. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/190. L. G. Stang, Jr., W. D. Tucker, R. G. Doering, A. J. Weiss, M. W. Greene, and H. O. Banks. London, Pergamon Press, Ltd., 1957. 18p.

Methods are described for the reactor production of Mg^{28}, I^{132}, I^{133}, and F^{18}. Data are included on the decay scheme and half-life of each isotope. A laboratory procedure is described for the separation of Y^{90} from Sr^{90} by elution from a cation exchange resin on which the Sr^{90} has been firmly fixed. (C.H.)

380
MEASUREMENT OF THE (p,n) THRESHOLDS OF Mo ISOTOPES, COMPLETING THE SYSTEM OF DIFFERENCES OF MASS OF Mo—Tc ISOBARS. Claudine Latapie, Christiane Levi, Lily Papineau, and Noelle Saunier. Compt. rend. 245, 672-5(1957) Aug. 5. (In French)

These measurements permit the completion of data on the bonding energy of the last neutron of Mo. Indications of the isomeric filling-in and the marked closing of the $d\ ^5/_2$ layer, and the deviation (>1 Mev for levels of particles $d\ ^5/_2$ to $g\ ^7/_2$) are given. The levels at about 700 kev of Mo^{95} and Mo^{97} would be brought closer to those of adjacent even isotopes of Mo and uneven isotopes of Nb. (tr-auth)

381
ALPHA SPECTRUM OF Bi^{212}. Robert J. Walen and Geneviève Bastin-Scoffier. Compt. rend. 245, 676-7(1957) Aug. 5. (In French)

382
PRODUCTION OF CARRIER-FREE ALUMINUM-26 AND SODIUM-22. Robert A. Rightmire (Standard Oil Co. of Ohio, Cleveland); Truman P. Kohman (Carnegie Inst. of Tech., Pittsburgh); and Alexander J. Allen (Univ. of Pittsburgh). Intern. J. Appl. Radiation Isotopes 2, 274-9(1957).

Al^{26} and Na^{22} are produced simultaneously by deuteron bombardment of water-cooled high-purity Mg targets. A chemical procedure for isolating each nuclide in carrier-free and radiochemically pure state is outlined. With 15 Mev deuterons, the thick-target yields are: Al^{26}, 1.40 ± 0.13 dis/min/μAhr; Na^{22}, $(4.6 \pm 0.3) \times 10^6$ dis/min/μAhr. The half life of Al^{26} is estimated as $\sim 1 \times 10^6$ years, uncertain by a factor of about 2. (auth)

383
A SELECTED READING LIST OF USES OF ISOTOPES AND APPLIED RADIATION. R. J. Millett, comp. Intern. J. Appl. Radiation Isotopes 2, 287-94(1957).

The list comprises references to books and review articles only (with some reports and bibliographies). The references are taken from the published literature for the period 1950—1957 and are set out in each section in date order starting with the latest reference. No attempt has been made to cover the literature on methods of detection, dosimetry and health hazards, and radiobiology and genetic effects. (auth)

384
RADIOISOTOPES: USE THEM ON TOUGH PROBLEMS.

C. M. Crompton (National Lead Co. of Ohio, Cincinnati). Iron Age 180, No. 16, 111-14(1957) Oct. 17.

The use of radioactive isotopes by industry as gages and tracers is described. (W.L.H.)

385

RADIOISOTOPES. Willard F. Libby (U. S. Atomic Energy Commission). Nucleonics 15, No. 9, 118-21(1957) Sept.

Milestones in the distribution of radioisotopes by the Atomic Energy Commission during the past ten years are outlined. One-third of one percent of the industrial manufacturing and mining concerns in the United States at present utilize radioisotopes. Savings resulting from the use of radioisotopes amount to approximately one-half billion dollars a year. Rapid expansion in the use of radioisotopes is predicted due both to increased market penetration of already developed industrial applications, and the development of new applications for low-level tracing and high-level irradiation. (C.H.)

Isotope Separation

386 K-1330(Add.)

Oak Ridge Gaseous Diffusion Plant, Tenn.

A NOTE ON EXACT AND APPROXIMATE EQUILIBRIUM TIME FOR A SQUARE PLANT. Addendum. D. W. Burton. Nov. 4, 1957. 7p. Contract W-7405-eng-26. $0.50(OTS).

387

ON THE PREPARATION OF RADIOACTIVE SAMPLES BY MEANS OF ELECTROMAGNETIC ISOTOPE SEPARATION. Göran Andersson (Univ. of Uppsala, Sweden). Arkiv Fysik 12, 331-51(1957).

A small electromagnetic isotope separator has been constructed with special regard to investigations of synchrocyclotron-produced radioactivities. The requirements put forward, including the simultaneous collection at equal focusing conditions of a large fraction of the mass spectrum, were found to be fulfilled by the parallel beam type of magnetic analyzer. A brief review of the basic principles of the apparatus is given. Various measures aiming at increased efficiency of the process, improved focusing at higher ion currents, and more stable running conditions are discussed. The performance of the separator is illustrated by some actual investigations. The applications include mass assignments, β- and γ-ray spectrometry, half-life determinations in the region below 1 ms, measurements of relative yields of spallation and high energy fission products, and hot atom chemistry. (auth)

388

THE INFLUENCE OF TEMPERATURE ON ISOTOPIC SEPARATION UNDER THE EFFECT OF A CONTINUOUS CURRENT IN MOLTEN GALLIUM. Maurice Goldman, Guy Nief, and Étienne Roth. Compt. rend. 243, 1414-16 (1956) Nov. 5. (In French)

389

SEPARATION OF ISOTOPES WHEN AN ATOMIC BEAM PASSES THROUGH IONIZED SPACE. K. D. Sinel'nikov, B. G. Safronov, et. al. (Physico-Technical Inst., Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 115, 80-3(1957) July 1. (In Russian)

Theoretical analysis indicates the possibility of isotopic separation when an atomic beam consisting of mixed isotopes passes through the space in which it undergoes an electron bombardment. To detect this effect, it was necessary to use a triode monometric lamp which permitted on one hand the ionization of the passing beam and on the other the catching and binding of the new formed ions. Results of measurements and calculations of enrichment are included. (R.V.J.)

390

PHYSICAL PRINCIPLES OF THE TRENNDÜSE METHOD. PART I. G. Nardelli and A. Repanai. Energia nucleare (Milan) 4, 293-300(1957) Aug. (In Italian)

Experimental data obtained with the Trenndüse method by Becker and collaborators in the separation of gaseous mixtures, specially isotopic mixtures, are presented. The situation from a physical point of view is also critically examined. (auth)

391

THE FIRST EXPERIMENT OF DOUBLE MONOCHROMATION IN THE ELECTROMAGNETIC SEPARATION OF ISOTOPES. Ch. Cassignol. J. phys. radium 17, Suppl. No. 11, 113A-15A(1956) Nov. (In French)

After enumerating the causes liable to limit enrichment in isotopic separations, an electrostatic double monochromator is described. The first results show a gain of one order of magnitude in the enrichment coefficient, compared with ordinary separations. (auth)

392

A CHEMICAL METHOD FOR THE SEPARATION OF BORON ISOTOPES. G. M. Panchenkov, V. D. Moiseev, and A. V. Makarov (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 31, 1851-60(1957) Aug. (In Russian)

A chemical exchange method has been proposed for separating boron isotopes using BF_3 and a liquid complex compound of BF_3 decomposing at low temperatures. The system of BF_3 and anisole was used, and some of its properties have been investigated. A novel countercurrent arrangement was tested for separating boron isotopes based on the chemical exchange between BF_3 and its anisole complex. The method may be used for production of B^{10}-enriched boron on an industrial scale. (tr-auth)

Mathematics

393 AECU-3553

Los Alamos Scientific Lab., N. Mex.

A PROPOSAL FOR A GENERALIZED CARD KEY PUNCH. E. A. Voorhees. July 16, 1956. 12p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

A key punch is discussed which would be useful in any automatic coding system requiring the initial input to be made via cards with 12 rows such as the standard IBM card. The proposed key punch consists of a keyboard connected to a punch and a electric typewriter so that if a character is struck, it is both punched in a single card column and typed on a sheet of paper. Each character key contains three characters which may be used in superscript, subscript, or main line position. (M.H.R.)

394 AECU-3568

General Atomic Div., General Dynamics Corp., San Diego, Calif.

PROGRAM FOR CALCULATION OF THERMAL AGE OF NEUTRONS. George Hinman. Nov. 9, 1956. 13p. Project 16. Contract AT(04-3)-118. (GAMD-17). $3.30(ph OTS); $2.40(mf OTS).

The program presented is for use with the IBM-650 computer. (D.E.B.)

395 NNSD-NSPS-1002

Newport News Shipbuilding and Dry Dock Co., Va.

NUCLEAR SHIP PROPULSION STUDY PROJECT ANALYSIS OF TEMPERATURE TRANSIENTS IN PRESSURIZED WATER REACTOR SYSTEMS. J. B. Woodward, III. June 1, 1955. 36p. $6.30(ph OTS); $3.00(mf OTS).

A hand calculation method of analyzing temperature and power transients in a pressurized water reactor plant is developed, and is illustrated with numerical examples. (auth)

396 WAPD-TM-64
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A SURVEY OF NUMERICAL METHODS IN THE SOLUTION OF DIFFUSION PROBLEMS. G. Bilodeau and L. Hageman. July 1957. 87p. Contract AT-11-1-GEN-14. $2.50(OTS).

Basic matrix theory and diffusion, calculation of eigenvalues, and the solution of inhomogeneous linear systems of equations are included. (M.H.R.)

Measuring Instruments and Techniques

Refer also to abstract 35.

397 AECU-3484
Michigan. Univ., Ann Arbor.
FAST GEIGER-MUELLER COUNTERS: A LITERATURE REVIEW TO MAY 1947. W. Wayne Meinke. May 1957. 41p. Project No. 7. Contract AT(11-1)-70. $0.30(OTS).

398 AERE-EL/R-2336
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A REPORT ON GAMMA AND BETA GAMMA SURVEY EQUIPMENTS 1390A AND 1391A. J. H. Howes. Aug. 1957. 24p.

Instruments are described which were designed to meet a special requirement for the accurate measurement of β and γ dose-rate. The γ instrument measures from 10 mr/hr to 30 r/hr in eight ranges and the β instrument from 10 mr/hr to 100 r/hr in four ranges. (auth)

399 CRDC-721
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A METHOD OF CALCULATING FISSION GAS DIFFUSION FROM UO_2 FUEL AND ITS APPLICATION TO THE X-2-f LOOP TEST. A. H. Booth. Sept. 1957. 23p. (AECL-496).

A method for calculating the fraction of rare gas fission products that diffuses out of a UO_2 fuel element under reactor conditions is outlined. The method is based on the values of the diffusion constant found in laboratory experiments, and assumes that these remain unaltered during the period that the fuel is in the reactor. The method has been applied to two types of oxide in the X-2-f loop test of 1956 and the results compared with the amounts of fission gas found by analysis of the gases collected in sheath puncture experiments. The calculated values depend heavily on the estimated temperatures in the fuel. They are in close agreement with the experimental values provided that, in calculating the temperature, certain assumptions are made regarding the thermal expansion of the oxide cylinder. (auth)

400 DP-201
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A SENSITIVE CONTINUAL MONITOR FOR THE DETECTION OF AIRBORNE PLUTONIUM. Alwyn C. Lapsley. Feb. 1957. 13p. Contract AT(07-2)-1. $0.50(OTS).

A continual monitor that detects airborne plutonium dust has been built. An air impactor is used to collect the plutonium and to reject the background alpha activity in the air. The threshold for detection is between one-half and twice the maximum permissible biological concentration of plutonium. Such a concentration is detected within ten minutes of its appearance in the atmosphere. The operation of the monitor is completely automatic. (auth)

401 NP-6395
Sweden.
A SUGGESTED PROCEDURE FOR THE COLLECTION OF RADIOACTIVE FALLOUT. Includes Annex I: A Method for Monthly Collection of Radioactive Fallout. Kay Edvarson. Annex 2. The Computation of Infinite Plane 30-Year Doses from Radioactive Fallout. Bo Aler and Carl Johan Herrlander. [1957]. 22p.

402 NP-6433
Battelle Memorial Inst., Columbus, Ohio.
NEUTRON DOSIMETRY RESEARCH. Quarterly Progress Report No. 1 for the Period March 15 to June 14, 1957. W. S. Diethorn, D. J. Hamman, B. Dale, J. W. Moody, R. K. Willardson, E. Paskell, Jr., and P. Schall, Jr. June 30, 1957. 18p.

A survey of dosimeter systems of potential interest to the Signal Corps for personnel neutron dosimetry in mixed neutron and gamma radiation fields has been initiated. The results of this survey will be the basis for the selection of semiconductor, tissue-equivalent ionization chamber, and chemical recoil-proton systems which show promise for neutron dosimetry in the 0 to 600 rad dose range. An experimental program has been designed to evaluate several semiconductor systems. Design of a tissue-equivalent ionization chamber is discussed. 15 references. (C.H.)

403 WCRT-TM-56-144
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
SECOND MEETING OF THE ANP ADVISORY COMMITTEE FOR NUCLEAR MEASUREMENTS AND STANDARDS. S. A. Szawlewicz. Nov. 1956. 36p.

A tentative set of standards for nuclear measurements is proposed, and definitions of terms, units, and concepts are adopted. (T.R.H.)

404 WCRT-TM-57-53
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
FOURTH MEETING OF THE ANP ADVISORY COMMITTEE FOR NUCLEAR MEASUREMENTS AND STANDARDS. S. A. Szawlewicz, K. Wolfsberg, and W. R. Burrus. Apr. 1957. 16p.

(See also WCRT-TM-56-144.)

405 USNRDL-TR-152
Naval Radiological Defense Lab., San Francisco.
INVESTIGATION AND CORRELATION OF SOME PHYSICAL PARAMETERS OF FALLOUT MATERIAL. W. Williamson, Jr. Mar. 28, 1957. 40p. Project NS-081-001.

An attempt has been made to correlate some of the fundamental physical parameters of fall-out material. Parameters discussed are color and shape, activity, size, weight, and density. What little correlation that was possible among the accumulated data is presented together with the residual error. (auth)

406 USNRDL-TR-164
Naval Radiological Defense Lab., San Francisco.
INTERIM REPORT ON A FAST- AND SLOW-NEUTRON SURVEY METER. A. H. Redmond, E. J. Wesley, and J. H. McQuoid. May 1, 1957. 38p. Project NE-051-500.

An experimental model of a portable fast- and slow-neutron survey meter was constructed and tested for use in estimating dose rate around nuclear reactors. The instrument contains proportional counters sensitive to fast or slow neutrons. At a tolerance flux of either, the instrument reads in the neighborhood of halfscale. The model case measures about 6 by 6 by 11 in. Power is derived from five 1.5 volt flashlight cells, and the instrument should operate continuously for more than 60 hours at room temperature. A Pu source is used for a check of sensitivity to insure that the instrument is in calibration before use. (C.H.)

407 AEC-tr-3056

STUDY OF THE ATMOSPHERIC CONTENT OF Sr^{90} AND OTHER LONG-LIVED FISSION PRODUCTS. V. V. Kurchatov, ed. Translated from a publication of the Academy of Sciences, U.S.S.R., Moscow, 1956. 7p.

Radioactive dust was collected during 1955 by aircraft flying over the European part of the U.S.S.R. at heights of approximately 3,000 and 7,000 meters. A few flights were made over the Central Asian part of the U.S.S.R. The volume of air passing through the filter at each collection was about 10^5 m^3. Radiochemical analysis of the filters showed that Sr^{90}, Ce^{144}, Ru^{106}, and Cs^{137} were constantly present in the atmosphere. Analytical procedures are described and data are tabulated. Analysis of the data showed the relative atmospheric content of long-lived fission fragments to be substantially different from their normal content in explosion products. It is concluded that the data indicate a complex pattern involving shifts of air masses and the settling of the radioactive aerosols. (C.H.)

408 AEC-tr-3063

ELECTROPHORETIC DEPOSITS OF BORON ON DURALUMIN PLATES TO BE USED FOR NEUTRON FLUX MEASUREMENTS. F. M. Lang, P. Magnier, and C. Finck. Translated by K. S. Bevis from Report CEA-545 (1956). 8p.

409

THE PREPARATION OF SAMPLES FOR α-COUNTING BY THE DIRECT EVAPORATION OF ORGANIC SOLUTIONS. D. G. Tuck (U. K. Atomic Energy Authority, Windscale Works, Cumberland, Eng.). Anal. Chim. Acta 17, 271-4 (1957) Sept.

A method is described for the preparation of thin deposits of α-emitting elements by evaporation of solutions in organic solvents. By heating the periphery of the tray, a suitable temperature gradient is maintained across the tray, giving smooth evaporation of the solvent to leave a deposit which is suitable for α-counting. It has been shown that on a semi-routine basis, the method is rapid and gives good precision. (auth)

410

SCINTILLATION SPECTROMETER FOR GAMMA RAYS. Kurt Jordan. Arch. tech. Messen 260, 193-6(1957) Sept. (In German)

411

DETERMINATION OF THE POSITION OF CHARGED PARTICLES BY THE USE OF A SPARK DETECTOR. Paul-Gerhard Henning. Atomkern Energie 2, 81-8(1957) Mar. (In German)

412

THE γ-RAY SCINTILLATION SPECTROMETER. D. H. Peirson and P. Iredale (Atomic Energy Research Establishment, Harwell, Berks). Brit. J. Appl. Phys. 8, 422 (1957) Oct.

Refinements made to the design of a two-crystal, γ-ray scintillation spectrometer are briefly described. (M.H.R.)

413

DOSAGE DISTRIBUTION IN ROTATIONAL COBALT 60 THERAPY. A SIMPLIFIED METHOD OF COMPUTATION. C. Gregory (Radium Inst., Northwood, Middlesex). Brit. J. Radiol. 30, 538-43(1957) Oct.

414

THE EVALUATION OF THE DOSE TO THE THORAX IN ROTATIONAL COBALT 60 THERAPY. T. E. Burlin (Radium Inst., Northwood, Middlesex). Brit. J. Radiol. 30, 543-9(1957) Oct.

415

AN AUTOMATIC MONITOR FOR URANIUM CONTAINED IN THE AIR. I. Iori and T. Rossini (CISE Labs., Milano). Energia nucleare (Milan) 4, 319-22(1957) Aug.

An automatic and fast instrument for the measurement of alpha radioactivity in the air is described. It is particularly suitable in laboratories where uranium and its salts are handled, because it distinguishes the alpha radioactivity by uranium from that by radon. (auth)

416

FORMATION OF TRACKS OF HIGH ENERGY ELECTRON PAIRS IN PHOTOGRAPHIC EMULSION. R. Weill, M. Gailloud, and Ph. Rosselet. Helv. Phys. Acta 30, 278-80 (1957). (In French)

It was found that a three dimensional model of track formation in nuclear emulsion accounts for the ionization variation observed at the beginning of electron pairs of more than 10 Bev, whose energies are measured by relative multiple scattering. Energies evaluated on the base of dipole effect theory are overestimated 50 to 100 times. (auth)

417

GAMMA-RAY COLLIMATOR PENETRATION AND SCATTERING EFFECTS. Robert L. Mather (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). J. Appl. Phys. 28, 1200-7(1957) Oct.

Expressions are developed which give the amount of unidirectional radiation from a distant radiation source passing through a cylindrical hole in a slab of material, including the amount of radiation which penetrates the edges of the hole, as a function of angle between the radiation direction and the axis of the hole. The modifications necessary for sources at finite distances are indicated. These functions are integrated over appropriate angles for distant line sources, and for extended sources. It is shown that, to a first approximation, the results are the same as the geometrical aperture for a like diameter hole in a similar slab with one mean free path of material removed from each side. The effects due to scattering from the walls of the collimator are discussed and an approximate method of calculation is presented with results for a specific collimator. (auth)

418

EXPERIMENTAL GAMMA-RAY COLLIMATOR SENSITIVITY PATTERNS. F. M. Tomnovec and R. L. Mather (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). J. Appl. Phys. 28, 1208-11(1957) Oct.

The spatial sensitivity pattern of a gamma-ray collimator and NaI scintillation detector was explored with small radiation sources of three gamma-ray energies (0.145 Mev, 1.12 Mev, 1.59 Mev). The collimator used was a cylindrical hole of ½ in. diam through 8 in. of lead. The results are compared with calculated patterns. The effects of penetration of the collimator edges are clearly shown. (auth)

419

CHARACTERISTICS OF PLASTIC SCINTILLATORS. Louis J. Basile (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 27, 801-6(1957) Sept.

Information on the light output of a group of organic solutes in polyvinyltoluene has been obtained. The primary solutes studied are p-terphenyl and 2-phenyl-5-(4-biphenylyl)-1,3,4 oxadiazole (PBD), the latter being the most efficient. Of the secondary solutes studied, 4,4'-diphenylstilbene and 2,5-dibiphenylyl oxazole (BBO) are the most efficient. The best plastic scintillator developed contains a combination of 2-phenyl-5-(4-biphenylyl)-1,3,4 oxadiazole (PBD) and 4,4'-diphenylstilbene. The fluorescence spectra of these plastic scintillators were determined. When a secondary solute is added to a plastic scintillator the emitted light is mainly that of the secondary

solute. The effect on the light output of the plastic scintillator upon addition of diphenylmercury was also investigated. Regardless of which combination of solutes was used, the mercury compound proved to be a serious quencher of light output. (auth)

420

FLUORESCENCE OF NAPHTHALENE AND ANTHRACENE VAPORS UNDER β-RAY EXCITATION. Allan Shepp (Technical Operations, Arlington, Mass.). J. Chem. Phys. 27, 816-17(1957) Sept.

421

AN ARRAY OF GEIGER COUNTERS FOR MEASURING CHROMATOGRAMS OR OTHER DISTRIBUTIONS OF RADIOACTIVITY. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/1. C. W. Gilbert and J. P. Keene. London, Pergamon Press, Ltd., 1957. 8p.

An apparatus has been constructed to measure the distribution of radioactivity along a 30 cm chromatogram. The same principles can be used to design apparatus to measure other one or two dimensional distributions. The radition is detected by an array of 30 β-sensitive geiger counters at 1 cm spacing in a single envelope. This enables measurements to be made some 30 times more rapidly than is possible by the use of one counter alone. Thus the whole of a chromatogram 30 cm long with active spots as low as a few counts per minute (order 10^{11} curies) can be accurately measured with a single exposure of a few hours. Chromatograms containing a moderate amount of radio-activity can be measured in a few minutes. A unique feature of the apparatus is the simple method for determining the counting rate of each counter. A part of the electrical charge passed by each counter is collected by a probe and is stored on a condenser of high insulation. At the end of an exposure the voltages of the 30 condense condensers are read by an electrometer. These readings are proportional to the activities under each counter. The apparatus can be designed either as a sealed off counter or as a flow counter working at atmospheric pressure and using a very thin window suitable for C^{14}. (auth)

422

A SIMPLE LIQUID SCINTILLATION COUNTER FOR MEASURING TRITIUM AND CARBON-14. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/4. C. P. Haigh. London, Pergamon Press, Ltd., 1957. 8p.

Beta emitting isotopes are conveniently measured by a scintillation method employing a preparation of the isotope in solution with a liquid phosphor. With isotopes of low beta-ray energy, such as C^{14} and H^3 for which the method is particularly attractive, a limiting factor is the thermionic noise from the photomultiplier tube. Coincidence techniques and refrigeration, resulting in elaborate and expensive equipment, have been used previously to reduce the number of thermionic pulses, but improved phototubes have now made possible a useful performance at low beta-ray energies with relatively simple equipment. An apparatus is described which uses a single photomultiplier in conjunction with a conventional linear amplifier. With a liquid scintillator of 3% 2,5-diphenyloxazole in toluene it provides for C^{14}, at ambient temperature, a counting efficiency of over 50% with a background of about 2 cps. Cooling to –20°C improves these figures to 90% and 1 cps respectively and in addition, enables tritiated water samples to be counted with an efficiency of at least 20% and a background not greater than 15 cps. The actual performance with tritium depends on the characteristics of the particular phototube and on the composition of the combined liquid scintillator and tritium sample, but the equipment is certainly capable of measuring down to 10^{-9} c of tritium. The instrument is suitable for measuring human total body water with small doses of tritiated water. (auth)

423

SIMULTANEOUS RECORDING OF THE INSTANTANEOUS COUNTING RATES OF P^{32} AND I^{131} IN THE BLOOD STREAM OF AN ANIMAL. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/147. A. C. Groom, P. W. Roberts, and S. Rowlands. London, Pergamon Press, Ltd., 1957. 7p.

424

SCINTILLATION COUNTING OF BETA EMITTERS. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/RIC/NS/204. H. H. Seliger. London, Pergamon Press, Ltd., 1957. 10p.

425

NUCLEAR INSTRUMENTATION. Denis Taylor (Plessey Nucleonics, Ltd.). Nucleonics 15, No. 9, 111-13(1957) Sept.

Recent developments in the design of radiation detection instruments are reviewed. The increasing use of transistors and ferrite loops is predicted, and the advantages and disadvantages of each is discussed. New production techniques, encapsulation, printed wiring, and expendable subassemblies are expected within the near future. It is expected that instrumentation will be simpler but more reliable, and will include more data processing. Small bench-type pulse-height analyzers, and instruments combining the functions of pulse-height analyzer and the time-of-flight spectrometer are predicted. It is also expected that whole-body counters will be an important health physics tool. (C.H.)

426

ENCAPSULATION MAKES MONITOR INDEPENDENT OF ENVIRONMENT. Martin H. Jachter and Abraham E. Cohen (U. S. Army Signal Engineering Labs., Fort Monmouth, N. J.). Nucleonics 15, No. 9, 148, 150, 152(1957) Sept.

427

AURAL COUNTING-RATE INDICATOR. C. C. Harris, P. R. Bell, and J. E. Francis (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 9, 152, 154(1957) Sept.

428

POWER SUPPLY FOR INTERCHANGING SCINTILLATION COUNTERS AND SCALERS. W. L. Scaff, K. E. Bagwell, and P. C. Johnson (Veterans Administration Hospital, Oklahoma City). Nucleonics 15, No. 9, 162, 164(1957) Sept.

429

BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY. NUMBERS 1-8 FOR APRIL, 1955 THROUGH MARCH, 1957. Tokyo, The Japan Meteorological Agency, 1955-57. 570p. (In English and Japanese)

On April 1, 1955, a program of fall-out radioactivity monitoring was inaugurated in Japan. The facilities of the meteorological observation network of the Central Meteorological Observatory are utilized and samples are collected at 15 weather stations, one ocean weather station, and one oceanographic observation ship. Data are collected on the mean radioactivity in rain; the maximum radioactivity in rain; radioactivity in dust; and the radiochemical content of large quantities of rain water. Other activities include the inspection and adjustment of instru-

ments and a research program. A brief description is presented of the methods of observation. Data collected from April 1955 through March 1957 are tabulated. (C.H.)

430
SEMI-CONDUCTING DEVICE FOR γ-RAY DETECTION. S. M. Ryvkin, A. P. Bogomazov, et al. (Physico-Tech. Inst., Leningrad). Zhur. Tekh. Fiz. 27, 1601-2(1957) July. (In Russian)

Mesons

431 NYO-2095
Rochester, N. Y. Univ.
THE NATURE OF THE FOUR-FERMION INTERACTION. E. C. G. Sudarshan and R. E. Marshak. Sept. 16, 1957. 13p. Contract AT(30-1)-875. $3.30(ph OTS); $2.40(mf OTS).

The near equality of the effective coupling constants in the processes of β decay, μ decay, and μ capture has led to the postulation of a universal fermi interaction between the pairs of spinorfields np, $\mu\nu$, $e\nu$. The weak decays of the strange particles are consistent with an effective coupling constant of the same order of magnitude and can be understood by adding the Λ^0p pair to the above pairs of spinors. The possibility of a universal four-fermion interaction was reexamined in the light of the recent experimental results on the non-conservation of parity and charge conjugation in weak interactions. From measurements on β, μ, π, and κ decay and the assumptions of the two-component neutrino and the law of conservation of leptons, it is concluded that the only possible universal four-fermion interaction is an equal admixture of vector plus axial vector interaction. Several experiments appear to contradict this hypothesis and their status is reexamined. (auth)

432 AEC-tr-3019
NEGATIVE K-MESON PRODUCTION THRESHOLD. M. Danysz and B. Pontecorvo. Translated from Zhur. Eksptl' i Teoret. Fiz. 32, 398-9(1957). 5p.

An experiment is proposed for verifying that θ^0 particles are a two-particle mixture. (D.E.B.)

433
MULTIPLE SCATTERING OF COSMIC RAY MESONS IN LEAD. Otto Claus Allkofer, Erich Bagge, Paul-Gerhard Henning, and Lothar Schmieder. Atomkern Energie 2, 88-93(1957) Mar. (In German)

The multiple scattering of cosmic μ mesons in Pb of various thicknesses is corrected and is compared to the theory of Moliere. (tr-auth)

434
TIME REVERSAL EFFECTS IN MUON DECAY. Robert T. Sharp and Glen Bach (McGill Univ., Montreal, Quebec). Can. J. Phys. 35, 1199-1203(1957) Oct.

Expressions are given for the distribution of electrons emitted in the decay of aligned muons as a function of their energy, direction, and spin. The two-component neutrino theory of Yang and Lee is used and two cases are considered: neutrino and antineutrino emitted; two neutrinos emitted. Various correlation terms arise as a result of the inclusion of electron spin. Among these is a time reversal dependent term whose presence would be evinced by asymmetry in a transverse polarization of electrons emitted at right angles to the muon spin. (auth)

435
THE WEAK INTERACTIONS OF BARYONS AND π-MESONS. Bernard d'Espagnat. Compt. rend. 245, 894-6 (1957) Aug. 26. (In French)

Weak baryon–π-meson interactions are put in a form which is analogous in structure to the corresponding strong interactions. A choice of coupling constants is proposed which accounts for some experimental data on sigma disintegration. (tr-auth)

436
PASCHEN-BACK EFFECT AS A MEANS OF DETECTING MUONIUM. Richard A. Ferrell and Fernando Chaos (Univ. of Maryland, College Park). Phys. Rev. 107, 1322-3(1957) Sept. 1.

Although formation of muonium (the bound system of a μ^+ meson and an electron) can be expected in suitable materials, the precession test for it has been negative. Since this test is sensitive to slight perturbations it is proposed to substitute for it a more positive and insensitive test which uses a strong magnetic field in the direction of the initial muon orientation rather than a weak field at right angles. In this way the depolarizing effect of the muonium hyperfine coupling is quenched and the beta-decay asymmetry will be increased. The amount of increase determines the fraction of muons forming muonium. For a field of five kilogauss the quenching should be 90% complete. (auth)

437
POSSIBILITY OF HYPERFRAGMENT FORMATION IN K^-–d REACTIONS. A. Pais (Inst. for Advanced Study, Princeton, N. J.) and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 107, 1396-1400(1957) Sept. 1.

If there exist bound Σ^--neutron and/or Λ^0-proton systems, the interaction between slow K^--mesons and deuterons may be an effective means for their production. Estimates are given for the ratio Γ of production of bound states to the corresponding free states for the reactions $K^- + d \rightarrow \Sigma^- + n + \pi^+$ or $\Lambda^0 + p + \pi^-$, where the K^- is supposed to be bound in a low-lying atomic orbit. The following connected alternatives must be considered: (1) K^- is scalar or pseudoscalar, (2) the capture takes place from an atomic s- or p-state, (3) the final bound state is ^3S and ^1S. The ^3S and ^1S cases are qualitatively different. Apart from this it turns out that Γ depends mainly on the binding energy of the hyperon-nucleon system and is insensitive to its effective range. If the (Σ^-,n) system is bound in a ^3S-state with an energy ~1 Mev, Γ may be anticipated to be of order unity. It is also noted that the reactions in question may yield partially polarized hyperon beams. (auth)

438
ASSOCIATED PRODUCTION IN PION-NUCLEON COLLISIONS AND CHARGE INDEPENDENCE. Saul Barshay (Univ. of California, Berkeley). Phys. Rev. 107, 1454 (1957) Sept. 1.

Using the method of Low, the equation for the Heisenberg scattering amplitude describing the processes $\pi + N \rightarrow \Lambda + K$ and $\pi + N \rightarrow \Sigma + K$ was derived. In the one meson approximation, with pair intermediate states omitted, a linear integral equation was obtained for this amplitude. (M H.R.)

439
EXPERIMENTAL μ^--CAPTURE RATES: EVIDENCE ON EXCLUSION PRINCIPLE EFFECTS AND THE TYPE OF INTERACTION. J. C. Sens, R. A. Swanson, V. L. Telegdi, and D. D. Yovanovitch (Univ. of Chicago, Ill.). Phys. Rev. 107, 1464-5(1957) Sept. 1.

Comparison is made of μ capture rates measured in 27 elements and compounds with Primakoff's theoretical predictions. (M.H.R.)

440
RE-ESTABLISHMENT OF μ^+ POLARIZATION IN DEPOLARIZING MEDIA BY AN EXTERNAL MAGNETIC FIELD. J. C. Sens, R. A. Swanson, V. L. Telegdi, and D. D. Yovanovitch (Univ. of Chicago, Ill.). Phys. Rev. 107, 1465-7 (1957) Sept. 1.

441

ELASTIC SCATTERING OF A Σ^+ HYPERON FROM A FREE PROTON. Francis C. Gilbert and R. Stephen White (Univ. of California, Livermore). Phys. Rev. 107, 1685-6(1957) Sept. 15.

An event has been found in nuclear emulsion which is interpreted as an elastic scattering of a Σ^+ hyperon from a free proton. The center-of-mass scattering angle was 125 degrees and the energy of the hyperon at the point of scattering was 22.9 Mev. (auth)

442

INTERACTION OF K^+ MESONS IN THE INTERVAL 30-65 Mev. T. F. Hoang, M. F. Kaplon, and R. Cester (Univ. of Rochester, N. Y.). Phys. Rev. 107, 1698-1708(1957) Sept. 15.

A systematic study of the scattering of 1173 definitely identified K_L mesons and 279 τ (including τ') mesons has been made in the energy interval 30-65 Mev using photoemulsion exposed to the Berkeley K^+ meson beam. All scatterings of K^+ mesons having a projected angle greater than 2° on the emulsion plane were recorded and analyzed. The results of analysis are the following: the interaction properties of the K_L and τ mesons are essentially indistinguishable; the coherent nuclear scattering of K^+ mesons interferes constructively with the Coulomb scattering; in terms of the optical model, the best fit for coherent scattering corresponds to a real potential of $\sim +15$ Mev, and the inelastic scattering gives an imaginary potential of ~ 3.6 Mev; charge exchange is rare in this energy region: σ(charge exchange)/σ(incoherent) $< 1/10$. A tentative interpretation of the results in terms of states of isotopic spin T = 0 and T = 1 is presented. A discussion is also given on the characteristic features of K^+ stars. (auth)

443

RADIATIVE YIELDS OF THE K SERIES IN π-MESONIC ATOMS. Martin Stearns and Mary Beth Stearns (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 107, 1709-11(1957) Sept. 15.

The total radiative yields of the K-series lines from π-mesonic atoms have been measured for the elements Li through F, inclusive, and Na. The yield is a maximum at Be, 21%, and falls to about 3% at Na. The yields of N, O, and F are roughly comparable. This anomaly may be due to a magic-number effect at Z = 8. (auth)

444

PION CONTRIBUTION TO HYPERON-NUCLEON FORCES. Don B. Lichtenberg and Marc H. Ross (Indiana Univ., Bloomington). Phys. Rev. 107, 1714-21(1957) Sept. 15.

A calculation is made of the forces between hyperons and nucleons under the assumption that the forces are due to the exchange of pions. The Λ and Σ are assumed to have spin $\frac{1}{2}$ and the same parity. The Hamiltonian is taken to be the same as the static-model pion-nucleon Hamiltonian except for differences in isotopic spin and possibly in the strength of the coupling. The same approximations are made as those ordinarily made in evaluating the nucleon-nucleon potential, although it is noted that in case all the pion-baryon coupling constants are equal, the hyperon-nucleon potentials are just linear combinations of the observed nucleon-nucleon potentials. The pion-hyperon coupling constant is determined by comparison with potentials obtained from analysis of hyperfragment data. The resulting value is about the same as the pion-nucleon constant. The elastic hyperon-nucleon and $\Lambda + N \rightleftharpoons \Sigma + N$ scattering cross sections are evaluated. Results are consistent with experiment. (auth)

445

RADIATIVE BETA DECAY OF THE PION. J. M. Cassels, M. Rigby, A. M. Wetherell, and J. R. Wormald (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 729-34(1957) Oct.

Theoretically about 1 pion in 10^3 is expected to decay by the process $\pi^+ \rightarrow P + \bar{N} \rightarrow e^+ + \nu + \gamma$, where the first stage is equivalent to a Yukawa reaction and the second to nuclear beta decay. A search for electron–photon coincidences from stopped positive pions has shown that in fact probably less than 1 pion in 10^8 decays in this way. (auth)

446

QUANTUM NUMBERS OF THE LEE-YANG PARITY DOUBLET THEORY OF STRANGE PARTICLES. R. Gatto. Z. Physik 147, 261-3(1957).

The commutation rules between the relevant operators of the Lee-Yang parity doublets theory of strange particles are derived. It is shown that new quantum numbers can be constructed which provide new selection rules in physically important cases. (auth)

Molecular Properties

447

MONTE CARLO EQUATION OF STATE OF MOLECULES INTERACTING WITH THE LENNARD-JONES POTENTIAL. I. SUPERCRITICAL ISOTHERM AT ABOUT TWICE THE CRITICAL TEMPERATURE. W. W. Wood and F. R. Parker (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 27, 720-33(1957) Sept.

Values obtained by Monte Carlo calculations are reported for the compressibility factor, excess internal energy, excess constant-volume heat capacity, and the radial distribution function of Lennard-Jones (12,6) molecules at the reduced temperature $kT/\epsilon^* = 2.74$, and at thirteen volumes between $\nu/\nu^* = 0.75$ and 7.5. (ν is the molar volume; $\nu^* = 2^{-1/2}N_0 r^{*3}$; N_0 is Avogadro's number; ϵ^* is the depth, and r^* the radius of the Lennard-Jones potential well.) The results are compared with the experimental observations of Michels ($\sim 150-2000$ atmos) and Bridgman ($\sim 2000-15\,000$ atmos) on argon at 55°C, using Michels' second virial coefficient values for the potential parameters. Close agreement with Michels is found, but significant disagreement with Bridgman. The Monte Carlo calculations display the fluid-solid transition; the transition pressure and the volume and enthalpy increments are not precisely determined. The Lennard-Jones-Devonshire cell theory gives results which disagree throughout the fluid phase, but agree on the solid branch of the isotherm. Limited comparisons with the Kirkwood-Born-Green results indicate that the superposition approximation yields useful results at least up to $\nu/\nu^* = 2.5$. (auth)

448

TUNNELING THROUGH HIGH PERIODIC BARRIERS. II. APPLICATION TO NUCLEAR MAGNETIC RESONANCE IN SOLIDS. T. P. Das (Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 27, 763-81(1957) Sept.

Analytic formulas derived in an earlier paper for the frequency of tunneling through high periodic barriers are used to derived from nuclear magnetic resonance data in solids the heights of the potential barriers hindering the rotational motion of molecules. The rotations of CH_3 groups, NH_3^+ groups, benzene, NH_2 groups and water molecules of crystallization are considered. The use of the barrier heights in correcting for the effect of torsional vibrations of molecules on molecular dimensions obtained from nuclear magnetic resonance data is illustrated. A possible explanation of an isotropic part of the splitting of the proton resonance in $Li_2SO_4 \cdot H_2O$, reported earlier by Pake, is presented. Comments are made on the relative

magnitudes of the barrier heights in the different molecules considered. (auth)

449

THE ATOMIC HEATS OF TITANIUM, ZIRCONIUM AND HAFNIUM. N. M. Wolcott (Clarendon Lab., Oxford, Eng.). Phil. Mag. (8) 2, 1246-54(1957) Oct.

The specific heats of the metals Ti, Zr, and Hf have been measured between 1.2 and 20°K. Values of γ, the electronic specific heat coefficient, have been determined for these metals as 8.5, 7.25 and 6.3×10^{-4} cal/mole deg^2, while the corresponding values of the Debye θ in the continuum region are 430, 310 and 261°. The variation of θ with temperature has been investigated, and it is shown that there is a similarity in this variation for all three elements when a suitably reduced scale of temperature is used. (auth)

450

DENSITY AND VISCOSITY OF NORMAL FLUID IN DILUTE SOLUTIONS OF He^3 IN He^4. J. G. Dash and R. Dean Taylor (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1228-37(1957) Sept. 1.

The torsion pendulum technique has been applied to the study of normal fluid density and viscosity of dilute solutions of He^3 in He^4 from 1.3°K to the lambda points. Three isotopic mixtures and pure He^4 have yielded data which cover the range from 0 to 11 mole percent He^3 concentration. Lambda temperatures are found to vary as the two-thirds power of the He^4 mole fraction. Densities at T_λ indicate a liquid volume contraction proportional to the concentration of He^3. Normal fluid densities at low temperatures are described by a single analytic function for all solutions and temperatures studied. The experimental values may be interpreted in terms of an effective hydrodynamic density of He^3; empirical behavior of the effective He^3 density is seen to increase linearly with the density of superfluid, in qualitative agreement with the model suggested by Feynman. Viscosities of all solutions exhibit temperature variations similar to that of pure He^4. Dependence of the viscosity on He^3 concentration appears to be markedly nonlinear at all temperatures. Analysis of the data in terms of the Landau-Khalatnikov theory of viscosity, together with additional simple assumptions, yields an empirical estimate of the roton-He^3 atom collision cross section. (auth)

Neutrons

451 NDA-15-94

Nuclear Development Corp. of America, White Plains, N. Y.

THE AGE OF FISSION NEUTRONS IN WATER AT THE INDIUM RESONANCE. J. Certaine. Aug. 15, 1957. 6p. Contract AT(30-1)-862. $1.80(ph OTS); $1.80(mf OTS).

The age at 1.4 ev of neutrons in water from a plane isotropic fission source is calculated by the moments methods with various angular distributions for elastic oxygen scattering, one of which is designed to yield a maximum theoretical value. (auth)

452 NDA-15-97

Nuclear Development Corp. of America, White Plains, N. Y.

PENETRATION OF 14 MEV NEUTRONS IN WATER. J. Certaine and H. Goldstein. Aug. 29, 1957. 8p. Contract AT(30-1)-862. $1.80(ph OTS); $1.80(mf OTS).

Comparisons are made between an experimental fast neutron dose from a point isotropic 14 Mev source in water and two calculated results, one of which treats inelastic oxygen scattering as an absorption. (auth)

453 WAPD-P-361

[Westinghouse Corp. Atomic Power Div., Pittsburgh.]

NEUTRON DEGRADATION IN AN ABSORBING HYDROGENOUS MODERATOR. Daniel Schiff. Oct. 21, 1953. Decl. Sept. 28, 1955. 7p. Contract [AT-11-1-GEN-14]. $0.15 (OTS).

454

ANGULAR DISTRIBUTION IN INELASTIC SCATTERING OF FAST NEUTRONS. Victor Naggiar, Gérald C. Phillips, Monique Roclawski-Conjeaud, and Dolly Szteinszaider. Compt. rend. 245, 668-70(1957) Aug. 5. (In French)

By a neutron-gamma coincidence technique, the asymmetry with respect to 90° was measured for inelastic scattering of neutrons by Fe^{56} at 1.5, 1.58, and 1.66 Mev and by I^{127} at 1.15 Mev. The asymmetry observed in the case of I^{127} is too weak to constitute the proof of a process of direct interaction. (tr-auth)

455

MEASUREMENT OF BETA ASYMMETRY IN THE DECAY OF POLARIZED NEUTRONS. M. T. Burgy, R. J. Epstein, V. E. Krohn, T. B. Novey, S. Raboy, G. R. Ringo (Argonne National Lab., Lemont, Ill.) and V. L. Telegdi (Univ. of Chicago, Ill.). Phys. Rev. 107, 1731-3(1957) Sept. 15.

The relative probability of β emission by the neutron was measured in the directions respectively parallel and antiparallel to their spin. The angular distribution relative to the neutron spin direction is $W(\theta) = 1 - (0.37 \pm 0.11)(v/c) \cos \theta$. (M.H.R.)

456

NEUTRON TRANSPORT THEORY. B. Davison and J. B. Sykes. Oxford, At The Clarendon Press, 1957. 471p.

An account of the principal methods used in neutron transport theory is given, together with a brief discussion of their relative suitability in various situations. The more refined forms of the spherical harmonics method, the Serber-Wilson method, and chief methods for dealing with energy-dependent problems are covered, including age theory, the method of polynomial approximations, Feynman's method, etc. Some methods already described in previous books on related subjects are also included. (M.H.R.)

Nuclear Physics

457 NAA-SR-1974

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REACTOR PHYSICS QUARTERLY PROGRESS REPORT [FOR] JANUARY–MARCH 1957. M. Carl Walske, ed. Aug. 15, 1957. 15p. Contract AT-11-1-GEN-8. $0.50 (OTS).

A series of exponential experiments with one-inch diameter U rods in diphenyl has been started. Initial measurements have been made to determine the height of thermal column and amount of external shielding needed. Fuel enrichments of 0.5, 0.7, and 0.9% U^{235} will be used with one-inch diameter rods at lattice spacings varying from 1.5 to 2.5 inches. New techniques for making flux distribution measurements are being developed in order to overcome the problems which have arisen because of the use of diphenyl as a moderating material for the experiments. By application of the age-diffusion theory approximation, the non-leakage probability of neutrons from a spherical medium containing a centrally-located fast source is shown, for large sphere radius, to be proportional to $\exp(-\pi^2 M^2/3R^2)$, where R is the radius of the sphere and M^2 the migration area of the neutrons in the medium. This functional dependence was verified by experimental measurement of the non-leakage probabilities of neutrons from fast sources contained in spheres of water, TiH, and CaH. For a mock-fission source, analysis of the data leads to values of 43 ± 2, 24 ± 2, and 100 ± 10

cm^2 for the migration areas in these materials, respectively. An effort was made to relax two approximations upon which the Wilkins equation rests. The one condition, i.e., no chemical binding, has been relaxed in an approximate way involving the use of a judiciously chosen three-parameter approximation for the center-of-mass scattering cross section, which was introduced by Brown and St. John. A differential equation analogous to the Wilkins equation but involving this approximation was obtained and is now being coded for IBM 704 solution. An attempt was made to relax the second condition, i.e., heavy moderator mass, and it became clear that more refined approximations to the Wigner-Wilkins kernel would not lead to further simplification. (For preceding period see NAA-SR-1864.) (auth)

458 UCRL-3715

California. Univ., Berkeley. Radiation Lab.

A POSSIBLE TEST OF A TWO-COMPONENT THEORY OF THE NEUTRINO. Tsuneyuki Kotani. Mar. 11, 1957. 7p. Contract W-7405-Eng-48. $1.80(ph OTS); $1.80(mf OTS).

The differences between the four-component theory of the neutrino and the new two-component theory are shown. A possible test of this difference in μ-meson decay is considered. (M.H.R.)

459 UCRL-3724

California. Univ., Berkeley. Radiation Lab.

A POSSIBLE TEST OF TIME-REVERSAL INVARIANCE IN BETA DECAY. Tsuneyuki Kotani. Mar. 27, 1957. 6p. Contract [W-7405-Eng-48]. $1.80(ph OTS); $1.80(mf OTS).

It is pointed out that the detection of a correction term, caused by a Coulomb distortion of the electron-wave function about the longitudinal polarization of the electron in β-decay, would indicate noninvariance under the T invariance. (M.H.R.)

460

ON THE THEORY OF THE DECAY AT QUASI-STATIONARY STATE. L. A. Khalfin (All-Union Research Inst. of Geophysical Prospecting). Doklady Akad. Nauk S.S.S.R. 115, 277-80(1957) July 11. (In Russian)

The theory of the decay in an almost stationary state is of importance in relation to studies of α decay, the passage of particles through potential barriers, the distribution of nuclear energy levels, etc. Some problems of the theory are investigated. (R.V.J.)

461

EVIDENCE OF VIOLATION OF PARITY BY β-γ POLARIZATION CORRELATION IN Co^{60}. P. Debrunner and W. Kündig. Helv. Phys. Acta 30, 261-3(1957). (In German)

462

THE ROLE PLAYED BY THE RADIOISOTOPES IN THE PARITY INVESTIGATION. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/224. C. S. Wu. London, Pergamon Press, Ltd., 1957. 7p.

The results of an investigation of the asymmetric beta angular distribution from polarized Co^{60} nuclei, which gave the first unequivocal proof of non-invariance of parity operation and charge conjugation in weak interactions, are presented. The subsequent developments in related fields are reviewed and discussed, particularly the theoretical and experimental implications in the field of beta-decay. (auth)

463

NUCLEAR PHYSICS. Gertrude Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.). Nucleonics 15, No. 9, 122-4(1957) Sept.

Recent developments in the field of nuclear physics are reviewed. It is predicted that the experimental determination of nuclear properties will increase in accuracy and scope as equipment and methods grow in diversity and ingenuity. Quantum mechanics may need to be modified, as by the introduction of the concept of a fundamental length, before nuclear phenomena can be explained. Definite progress may be expected in understanding the phenomena observed in fission, and relatively long-lived isotopes may be found among the far-transuranic nuclides because of magic-number stability. (C.H.)

464

TIME-REVERSAL INVARIANCE AND BETA-GAMMA ANGULAR CORRELATION. M. Morita and R. Saito Morita (Columbia Univ., New York). Phys. Rev. 107, 1316-21 (1957) Sept. 1.

The angular correlation functions between beta and gamma rays from oriented nuclei (with or without observing circular polarization) are given for use in testing the invariance of the beta interactions under time-reversal. If the beta interactions are noninvariant under time-reversal, the angular correlation functions have asymmetries, $W(\Theta,\theta,\varphi) \neq W(\Theta,\theta,-\varphi)$ and $W(\Theta,\theta,\varphi,P) \neq W(\Theta,\theta,-\varphi,P)$, where the axis of the nuclear orientation is chosen as the z-axis, and the beta and gamma rays are assumed to be emitted in the directions with polar angles, Θ, $\Phi \equiv$ zero, and θ, φ, respectively. P indicates the circular polarization of the gamma rays, and P = +1 (–1) for left (right) circular polarization. These asymmetries are of the order of $(p/W)\ \mathrm{Im}(C_T{}^*C_S' + C_T'{}^*C_S - C_A{}^*C_V' - C_A'{}^*C_V)$. The angular correlation functions between beta and gamma rays from unoriented nuclei (with or without observing circular polarization) are also considered. However, they do not give us a clear-cut experiment to test the invariance of the beta interactions under time-reversal. Another method to test time-reversal invariance is to measure the difference between the values of $\mathrm{Re}(C_i{}^*C_j)$ and $|C_i| \cdot |C_j|$, etc. This is discussed briefly. (auth)

465

SPIN-ORBIT COUPLING IN THE NEUTRON-PROTON INTERACTION. J. L. Gammel and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1337-40(1957) Sept. 1.

It is shown that if the nucleon-nucleon interaction is charge-independent, then the n-p scattering and polarization data in the energy range 0 to 310 Mev require the presence of a spin-orbit term in the triplet even-parity potential of the same short range as (but of somewhat less depth than) the spin-orbit term found previously for the triplet odd-parity potential. (auth)

466

BETA-GAMMA CORRELATIONS FROM ORIENTED NUCLEI. R. B. Curtis and R. R. Lewis (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 107, 1381-2(1957) Sept. 1.

The measurement of the correlation function for β-γ transitions in oriented nuclei is proposed as a means of determining the validity of time-reversal invariance in the β interaction. Such experiments also provide a sensitive test of the type of Fermi interaction. The correlation function for allowed transitions ($\Delta J = 0$, no) is presented in general form, with a discussion of the conclusions which can be drawn from such experiments. (auth)

467

ANOMALOUS MAGNETIC MOMENTS OF NUCLEONS IN NUCLEON-PHOTON INTERACTION. Suraj N. Gupta (Wayne State Univ., Detroit, Mich.). Phys. Rev. 107, 1442-5(1957) Sept. 1.

The validity of the usual phenomenological treatment of the anomalous magnetic moments of nucleons is investigated for processes involving nucleon-photon interaction. By using the charge-symmetrical pseudoscalar meson theory with pseudoscalar coupling, it is shown that the phe-

nomenological treatment completely breaks down for photon energies of a few hundred Mev in the rest system of the nucleon. (auth)

468

"TWIN" NEUTRINOS: A MODIFIED TWO-COMPONENT THEORY. Maria Goeppert Mayer (Argonne National Lab., Lemont, Ill. and Univ. of Chicago, Ill.) and Valentine L. Telegdi (Univ. of Chicago, Ill.). Phys. Rev. 107, 1445-7 (1957) Sept. 1.

To overcome certain discrepancies between experiment and the predictions of conventional 2-component neutrino theory, a twin neutrino theory is proposed. In the more general formulation of this theory in part I, two different 2-component neutrinos ν_1, ν_2 of opposite screw-sense are introduced, together with their antiparticles $\bar{\nu}_1$, $\bar{\nu}_2$. In beta decay, one of these is coupled by T and V interactions, the other by S and A interactions. This eliminates all interference terms. In part II, the theory is specialized to the assumption $\bar{\nu}_1 \equiv \bar{\nu}_2$, i.e., to Majorana-type neutrinos. This more restricted theory is equally successful in explaining the results of the parity experiments. It is shown that the conventional objections to the Majorana theory need not apply to this twin-neutrino theory. (auth)

469

HEAVY-FERMION MASS SPECTRUM. D. Kleitman (Harvard Univ., Cambridge, Mass.). Phys. Rev. 107, 1453-4 (1957) Sept. 1.

The heavy-fermion mass spectra predicted by several previously suggested Lagrangians were investigated and results are given. (M.H.R.)

470

β-γ CIRCULAR POLARIZATION CORRELATION IN Au^{198} AND Co^{58}. F. Boehm and A. H. Wapstra (California Inst. of Tech., Pasadena). Phys. Rev. 107, 1462(1957) Sept. 1.

471

SEARCH FOR ANTINEUTRINO INTERACTION WITH DEUTERONS. Clyde L. Cowan, Jr. and Frederick Reines (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1609-11 (1957) Sept. 15.

The antineutrino-induced disintegration of the deuteron was sought using the antineutrino flux from a production reactor at the Savannah River Plant and a liquid scintillation detector, with a negative result. An upper limit of 4×10^{-45} cm^2 was placed on the interaction cross section as compared with present predictions of 2×10^{-45} cm^2 for this cross section. Suggestions are given for improving this experimental limit. (auth)

472

MAGNETIC MOMENT OF THE DEUTERON AND NUCLEON-NUCLEON SPIN-ORBIT POTENTIALS. Herman Feshbach (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 1626-7(1957) Sept. 15.

The change in the magnetic moment of the deuteron arising from the presence of a spin-orbit potential in the nucleon-nucleon interaction has been estimated for two recent proposals. The effects are found to be substantial. (auth)

473

TIME-DEPENDENT HARTREE-FOCK THEORY OF NUCLEAR COLLECTIVE OSCILLATIONS. Richard A. Ferrell (Univ. of Maryland, College Park). Phys. Rev. 107, 1631-4(1957) Sept. 15.

A theory of nuclear collective oscillations is presented which does not involve introducing extra variables and subsidiary conditions. This time-dependent self-consistent field method is applied to the breathing mode of a spherically symmetric nucleus and yields a value for the frequency of oscillation which is more accurate than that from a previous treatment in terms of one-nucleon excitation, but which becomes identical to the latter in the case of weak nucleon-nucleon interaction. In cases where nucleon exchange can be neglected, the new estimate reduces to the frequency derived from the simple classical theory of a compressible fluid. By means of an electric monopole sum rule which is derived for $T = 0 \rightarrow T = 0$ transitions, it is shown that in general the classical formula overestimates the breathing mode frequency. From the sum rule it also follows that the 6.06-Mev 0^+ state in O^{16} is related only indirectly to the breathing mode, which must itself be at a higher excitation energy. (auth)

474

NUCLEON EXCHANGE IN DEUTERON STRIPPING REACTIONS. A. P. French (Univ. of South Carolina, Columbia). Phys. Rev. 107, 1655-63(1957) Sept. 15.

In the normal theory of stripping reactions it is assumed that the outgoing nucleon comes from the incident deuteron. It is well known that this is not strictly justified (although it may be a good approximation in many cases) because of the need in principle to antisymmetrize the total wave function. This paper discusses the process of stripping with nucleon exchange that appears when the antisymmetry is taken into account. With the help of simplifying assumptions, expressions are obtained for the exchange amplitude in a direct transition between initial and final states of the system. The relation of this treatment to a theory involving compound nucleus formation is discussed. (auth)

475

INTERNAL CONVERSION COEFFICIENTS FOR PURE E2 AND MIXED E2 + M1 TRANSITIONS. F. K. McGowan and P. H. Stelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 107, 1674-80(1957) Sept. 15.

K-shell internal conversion coefficients have been measured for a number of pure E2 and mixed E2 + M1 transitions resulting from the decay of low-lying rotational states. These states were produced either by Coulomb excitation or by radioactive decay. The experimental values for α_2^K are appreciably larger than the calculated values of Sliv and co-workers. (auth)

476

ANGULAR CORRELATIONS BETWEEN β RAYS AND CIRCULARLY POLARIZED γ RAYS IN TRIPLE CASCADE TRANSITIONS. M. Morita (Columbia Univ., New York). Phys. Rev. 107, 1729-30(1957) Sept. 15.

477

RELATIVISTIC WAVE EQUATIONS FOR SPIN-2 PARTICLES WITH UNIQUE MASS. O. Brulin (Univ. of Stockholm, Sweden) and S. Hjalmars (Royal Inst. of Tech., Stockholm, Sweden). Phys. Rev. 107, 1730-1(1957) Sept. 15.

Nuclear Properties

478 AFOSR-TN-57-607

Laval Univ., Quebec.

SPECTRUM OF L AUGER ELECTRONS FROM $_{81}Tl^{208}$ AND $_{83}Bi^{212}$. C. Geoffrion and G. Nadeau. July 1, 1957. 17p. Contract AF18(600)-1574.

The spectrum of L Auger electrons emitted by a source of Th(B+C+C") has been measured with a 180° beta-ray spectrometer. An empirical formula for the calculation of secondary ionization potentials has been used for a tentative identification of the transitions giving rise to the measured lines. (auth)

479

ON THE SYSTEMATICS OF TRANSITION PROBABILITIES OF M4 TRANSITIONS OF THE TYPE $h_{11/2} \rightarrow d_{3/2}$. DECAY OF Te^{133m}. Torsten Alväger and Gerda Oelsner. Arkiv Fysik 12, 319-30(1957).

A careful analysis is made of the radial matrix elements of M4 transitions of the type $h_{11/2} \rightarrow d_{3/2}$. It has previously been claimed that the matrix elements systematically increase towards the magic numbers. Especially the matrix element of Te^{133m} was found to be large in comparison with the matrix elements of the other Te isomers. For this reason the decay of Te^{133m} has been studied. The half-life of the isomeric state was found to be 53 ± 4 m with a decay energy of 334.0 ± 0.3 kev. Further, a large β-branching of 87% from the isomeric level was found. This reduces the empirical matrix element of Te^{133m} to the order of magnitude of the other matrix elements in the isomers of tellurium. It must therefore be concluded that there are no certain experimental proofs that the matrix elements of M4 transitions are larger when shells are almost filled. (auth)

480

FUNDAMENTAL CONCEPTS OF NUCLEAR PHYSICS. VI. THE STABILITY OF THE ATOMIC NUCLEUS. Werner Braunbek. Atomkern Energie 2, 109-11(1957) Mar. (In German)

481

THE DECAY OF Os^{185}. M. W. Johns, S. V. Nablo, and W. J. King (McMaster Univ., Hamilton, Ontario). Can J. Phys. 35, 1159-75(1957) Oct.

A study of the decay of Os^{185} with a magnetic beta-ray spectrometer, scintillation counters, and coincidence circuits reveals radiations of the following energies (in Mev.), intensities, and multipolarities: K-shell x-rays (65%), 0.0716 (0.4%, M1 + E2), 0.1255 (2.5%, M1 + E2), 0.1626 (1%, M1), 0.2334 (1.4%, E2), 0.5920 (1.1%, E2), 0.6458 (80%, E2), 0.7177 (4.1%, M1 + E2), 0.8720 (7.1%, M1 + E2), and 0.8789 (7.5%, M1 + E2). These transitions are interpreted in terms of a decay scheme involving the following levels in Re^{185}: 0(5/2+), 0.1255(7/2+), 0.6458(1/2+), 0.7176(3/2+), 0.872(3/2+), and 0.879(3/2+) Mev. The ratio of L-capture to K-capture considering decay to all levels of Re^{185} is 0.38 ± 0.07. The ratio of L-capture to K-capture to the 0.872 and 0.879 Mev. levels is 1.04 ± 0.04. This implies that the Os^{185}–Re^{185} atomic energy difference is 0.985 ± 0.007 Mev. The half-life of Os^{185} was found to be 93.6 ± 0.5 days. (auth)

482

SCANDIUM ISOTOPE OF MASS 42. J. A. R. Cloutier and A. Henrikson (McGill Univ., Montreal, Quebec). Can. J. Phys. 35, 1190-8(1957) Oct.

A member of the odd–odd Z = N family, Sc^{42}, has been produced by proton bombardment of a calcium target greatly enriched in Ca^{42}. The positron emission, which alone is observed, has a measured half-life of 0.68 second, end point 4.8. Mev., and threshold 6.8 Mev. The superallowed transition is between ground states (J, T) tentatively described as $Sc^{42}(0^+, 1)$ and $Ca^{42}(0^+, 1)$. (auth)

483

REACTOR NEUTRON CAPTURE CROSS SECTION OF 51-DAY Sr^{89}. L. P. Roy and J. C. Roy (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Phys. 35, 1215-19(1957) Oct.

The neutron capture cross section of Sr^{89} has been measured by an activation method. Naturally occurring strontium was irradiated in different high flux positions in the NRX reactor at Chalk River and the amount of Sr^{90} formed by successive neutron capture in Sr^{88} was determined by separating and measuring its daughter Y^{90}. Using values of 36.6 and 0.005 barns for the respective neutron capture cross sections of Co^{59} and Sr^{88}, the capture cross section of Sr^{89} for reactor spectrum neutrons was found to be 0.49 ± 0.10 barn. (auth)

484

THE FORM OF THE DISCONTINUITY OF ABSORPTION M OF GOLD. Chintamani Mande. Compt. rend. 245, 662-4 (1957) Aug. 5. (In French)

A study of the form of the M_{II}, M_{IV}, and M_V discontinuities of metallic Au is presented. It was found that the form of M_{III} is like L_{III} and that the M_{IV} and M_V discontinuities decompose in three successive steps. (tr-auth)

485

SPIN AND MAGNETIC MOMENT OF Zr^{91}. E. Brun, J. Oeser, and H. H. Staub. Helv. Phys. Acta 30, 267(1957). (In German)

The spin of Zr^{91} was found to be $\frac{5}{2}$ and the magnetic moment −1.29802 ± 0.00002 nuclear magnetons. (M.H.R.)

486

THE DECAY OF Cu^{67}. W. Beusch, P. Erdős, D. Maeder, and P. Stoll. Helv. Phys. Acta 30, 268-9(1957). (In German)

487

THE DECAY SCHEMES OF $Hg-Au^{195}$ AND $Hg-Au^{193}$. J. Brunner, J. Halter, and Ch. Perdrisat. Helv. Phys. Acta 30, 269-71(1957). (In German)

488

DECAY SCHEME OF Ra^{223}. H. Paul and H. Warhanek. Helv. Phys. Acta 30, 272-4(1957). (In German)

489

CONVERSION-ELECTRON AND PHOTON SPECTRA OF Gd^{147} AND Gd^{149}. Virginia S. Shirley, Warren G. Smith, and John O. Rasmussen (Univ. of California, Berkeley). Nuclear Phys. 4, 395-407(1957).

A new Gd isotope decaying by electron capture with a 29-hour half life was found. Its mass number was determined to be 147 by examination of its excitation function for production by alpha particle bombardment of $Sm_2{}^{147}O_3$. The electron-capture isotope Gd^{149} was also studied, and its half life was redetermined to be 9.3 ± 0.3 days. The conversion-electron and photon spectra of Gd^{147} and Gd^{149} were studied. Relative photon and electron intensities were determined for some of the transitions, and some coincidence measurements were made. From the data a few multipolarities are assigned and partial decay schemes are suggested. (auth)

490

CONTROLLED FUSION. Amasa S. Bishop (U. S. Atomic Energy Commission, Paris). Nucleonics 15, No. 9, 128-30 (1957) Sept.

The problems to be overcome in research on controlled fusion are discussed and some of the experimental work that has been underway in laboratories around the world during the past five years is described. It is predicted that the feasibility of a controlled fusion reactor will be demonstrated by 1967. (C.H.)

491

NUCLEAR FORCES AND THE STRUCTURE OF THE LITHIUM ISOTOPES. J. M. Soper (Cavendish Lab., Cambridge, Eng.). Phil. Mag. (8) 2, 1219-25(1957) Oct.

By consideration of the observed spectrum of Li^6 in intermediate coupling, values are obtained for the p-shell radial integrals, the spin-orbit force parameter and two of the three independent parameters of the exchange character of the central force. These results are used to calculate the spectrum and properties of Li^7 in intermediate coupling. Fresh evidence is found for the assignment of the 7.46 Mev level in Li^7 to the $5/2^-$ level of the P^{24} term, indicating the probable presence of a further $5/2^-$ level (from the F^{22} term) in the 5 to 7 Mev region. (auth)

492

THE ANGULAR CORRELATION OF THE GAMMA CASCADE IN SULPHUR 34. P. S. Fisher and G. G. Shute (Univ. of Birmingham, Eng.). Phil. Mag. (8) 2, 1255-63 (1957) Oct.

The angular correlation of the gamma cascade in S^{34} has been measured to be $1 + (0.332 \pm 0.032)P_2(\cos\theta) - (0.017 \pm 0.011)P_4(\cos\theta)$ and this is interpreted in terms of spin-sequence 2^+, 2^+, 0 with a mixture of 1.4% of E2 radiation in the first transition. A new angular correlation apparatus and fast coincidence system is briefly described. (auth)

493

HYPERFINE STRUCTURE OF K^{39} IN THE 4P STATE. P. Buck and I. I. Rabi (Columbia Univ., New York). Phys. Rev. 107, 1291-4(1957) Sept. 1.

The atomic-beam magnetic resonance method has been used to investigate the hyperfine structure of the 4P state of K^{39}. The apparatus and method of observation were similar to those used in previous experiments on Na, Rb, and Cs. For K^{39}, the magnetic-dipole interaction constant in the $4P_{1/2}$ state is $a_{1/2} = 28.85 \pm 0.3$ Mc/sec, the electric-quadrupole interaction constant in the $4P_{3/2}$ state is $b = 2.8 \pm 0.8$ Mc/sec, and the quadrupole moment is $(0.07 \pm 0.02) \times 10^{-24}$ cm^2. (auth)

494

THERMAL-NEUTRON FISSION CROSS SECTIONS FOR ISOTOPES OF PLUTONIUM, AMERICIUM, AND CURIUM. E. K. Hulet, R. W. Hoff, H. R. Bowman, and M. C. Michel (Univ. of California, Livermore). Phys. Rev. 107, 1294-6 (1957) Sept. 1.

The following thermal-neutron fission cross sections have been measured in the thermal column of the Materials Testing Reactor at Idaho Falls, Idaho: Pu^{238}, 18.4 ± 0.9 b; Am^{241}, 3.13 ± 0.15 b; Am^{242}, 6390 ± 500 b; Am^{243}, < 0.072 b; Cm^{243}, 690 ± 50 b; Cm^{245}, 1880 ± 150 b. In addition, a pile neutron capture cross section of 520 ± 40 b has been measured for Pu^{238}. (auth)

495

COULOMB EXCITATION OF ROTATIONAL LEVELS IN DYSPROSIUM. N. P. Heydenburg and G. F. Pieper (Carnegie Inst. of Washington, D. C.). Phys. Rev. 107, 1297-9(1957) Sept. 1.

The Coulomb excitation of energy levels in isotopically enriched targets of dysprosium has been investigated by alpha-particle bombardment. One rotational level was observed in each of the two even-even isotopes Dy^{162} and Dy^{164} with energies of 82 kev and 75 kev and transition probabilities $\epsilon B(E2)$ (in units of $e^2 \times 10^{-48}$ cm^4) equal to 1.65 and 1.09, respectively. Two rotational levels were excited in the odd-A isotope Dy^{161} with energies 46 kev and 103 kev, with values of $\epsilon B(E2)$ equal to 2.44 and 0.04. Two rotational levels were also observed in the isotope Dy^{163} at 75 kev and 166 kev, having $\epsilon B(E2)$ values of 0.43 and 0.67, respectively. There is also evidence for a 93-kev gamma ray in Dy^{163} which, from coincidence measurements, appears to be the cascade transition from the second to the first excited level. (auth)

496

COULOMB EXCITATION OF IRON-57. G. F. Pieper and N. P. Heydenburg (Carnegie Inst. of Washington, D. C.). Phys. Rev. 107, 1300-2(1957) Sept. 1.

Coulomb excitation experiments have confirmed the existence of excited states in Fe^{57} at 14, 137, and 365 kev. Gamma rays of energies 123, 228, and 350 kev were observed and their multipolarities determined. A level scheme incorporating these radiations with earlier information is proposed: ground state, $1/2^-$; 14-kev state, $3/2^-$; 137-kev state, $5/2^-$; and 365-kev state, $5/2^-$. The reduced upward transition probabilities, B(E2), in units of $e^2 \times 10^{-48}$ cm^4, for the two states excited are: 137-kev level, 0.050; 365-kev level, 0.033. (auth)

497

NUCLEAR ENERGY LEVELS EXCITED BY FAST NEUTRONS. Rolf M. Sinclair (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 107, 1306-10(1957) Sept. 1.

Fast-neutron inelastic scattering has been studied in a number of elements by observation of the deexcitation gamma rays with a single-crystal NaI(Tl) spectrometer. Neutrons of energy 4.4 ± 0.1 Mev were used to bombard isotopically enriched scatterers of Ti, Cr, Ni, Zn, Ge, and W, and normal scatterers of Cl, Sr, Nb, Nd, Sm, and Gd. The low-lying levels in Ti^{47}, I, and W are studied using neutron energies between 0.50 Mev and 1.45 Mev. Energies and relative yields of the gamma rays are given, and their assignment to various excited states is discussed. Previously unknown states were found in Ti^{48}, Cr^{50}, Zn^{64}, Zn^{66}, and Ge^{74}. (auth)

498

BETA DECAY OF THULIUM-171. W. G. Smith, R. L. Robinson, J. H. Hamilton, and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 107, 1314-15(1957) Sept. 1.

The radiations emitted in the decay of 1.9-year Tm^{171} have been studied with a 180°, 40-cm radius of curvature, shaped magnetic-field spectrometer, a scintillation spectrometer, and a 125-gauss permanent-field spectrograph. Beta-gamma coincidence measurements have also been made. Two beta groups with endpoint energies of 96.5 ± 1 kev and ~30 kev were observed. A 66.7 ± 0.5 kev transition, probably an M1 − E2 mixture, was also observed. Possible spin assignments are discussed. (auth)

499

DECAY OF ZINC-62. E. Brun, W. E. Meyerhof, J. J. Kraushaar, and D. J. Horen (Stanford Univ., Calif.). Phys. Rev. 107, 1324-33(1957) Sept. 1.

The excited levels of Cu^{62} have been investigated by studying the radiations from the decay of Zn^{62} with scintillation spectrometers. Gamma rays of 0.042-, 0.25-, 0.26-, 0.40-, 0.51-, and 0.59-Mev energy have been resolved and have been fitted into a consistent scheme of levels at 0.042, 0.30, 0.55, 0.63, and 0.70 Mev in Cu^{62}. Some information on the spins of these levels has been obtained by gamma-gamma directional correlation measurements. Information on some gamma rays from the decay of Cu^{62} has also been obtained. (auth)

500

ENERGY LEVELS IN CHROMIUM-52. M. Mazari, W. W. Buechner, and A. Sperduto (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 1383-6(1957) Sept. 1.

The excited states of Cr^{52} have been studied through the $Mn^{55}(p,\alpha)Cr^{52}$ reaction and by an investigation of inelastic proton scattering from chromium. A 6.51-Mev proton beam from an electrostatic generator and a high-resolution magnetic spectrograph were used. Excited states in Cr^{52} were found at 1.433, 2.368, 2.648, 2.767, 2.965, and 3.161 Mev. The Q-value for the ground-state transition in $Mn^{55}(p,\alpha)Cr^{52}$ is 2.568 ± 0.008 Mev. (auth)

501

RECOIL STUDIES OF HIGH-ENERGY FISSION OF BISMUTH AND TANTALUM. Norbert T. Porile and Nathan Sugarman (Univ. of Chicago, Ill.). Phys. Rev. 107, 1410-21 (1957) Sept. 1.

The recoil properties of a number of fission fragments formed in 450-Mev proton bombardment of Bi and Ta have been investigated radiochemically. The ranges of the fragments emitted in the direction of, and perpendicular to the beam were measured. The kinetic energies of the fragments were obtained from the measured ranges using a previously determined range-energy relation. The total average kinetic energy released in fission was found to be 111 Mev for Bi and 96 Mev for Ta. The energy deposited in the target nuclei for processes leading to the observed fragments was obtained from the forward-backward asymmetry and the other measured recoil parameters, and a

momentum-deposition energy relation from recent Monte Carlo calculations. The average deposition energy in the fission of Bi and Ta was found to be 160 Mev and 190 Mev, respectively. (auth)

502

ANALYSIS OF RESULTS OF HIGH-ENERGY NUCLEAR REACTIONS. Norbert T. Porile and Nathan Sugarman (Univ. of Chicago, Ill.). Phys. Rev. 107, 1422-30(1957) Sept. 1.

The determination of branching ratios for the formation of specific products at given deposition energies is described for high-energy nuclear reactions. These branching ratios may be obtained by use of deposition energy spectra from recent Monte Carlo calculations. The calculated branching ratios are used to analyze formation cross sections in the Bev region into fission and fragmentation components, and to calculate average and most probable deposition energies for the formation of specific nuclides. The fission process in bismuth is compared with that in tantalum as to relative fissionability, deposition energy for fission, and spread in fissioning nuclei. (auth)

503

ENERGY DEPENDENCE OF THE K^+-MESON INTERACTION CROSS SECTION. M. Widgoff (Harvard Univ., Cambridge, Mass.); A. Pevsner (Johns Hopkins Univ., Baltimore, Md.); D. Fournet Davis, D. M. Ritson, and R. Schluter (Massachusetts Inst. of Tech., Cambridge); and V. P. Henri (Northwestern, Univ., Boston, Mass.). Phys. Rev. 107, 1430-3(1957) Sept. 1.

K^+ interactions in nuclear photographic emulsion have been studied at three effective mean K^+ energies: 54 Mev, 95 Mev, and 140 Mev. The cross section for inelastic interaction is found to increase slightly with energy. The scattering appears to be s-wave, T = 1, at low energies, with p-wave scattering becoming appreciable above about 100 Mev. (auth)

504

DIFFERENTIAL AND TOTAL CROSS SECTIONS FOR NUCLEON-ANTINUCLEON SCATTERING. Fernando E. Prieto. Phys. Rev. 107, 1439-41(1957) Sept. 1.

By the use of perturbation theory to the second order, and pseudoscalar meson theory with pseudoscalar coupling, the differential and total cross sections for the scattering of antinucleons by nucleons are obtained. It is found that the cross section for charge-annihilation scattering is about $\frac{1}{3}$ that for normal scattering, and for both, a decrease of the cross section with increasing energy is obtained, and for a given energy the cross section decreases with increasing scattering angle. The results agree in general behavior and in order of magnitude with the available experimental data. (auth)

505

PLUTONIUM-237m, ANOTHER CASE OF E3 ISOMERISM FOR NEUTRON NUMBER 143. F. S. Stephens, Jr., Frank Asaro, Saadia Amiel, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 107, 1456-8(1957) Sept. 1.

506

COMPARISON OF THE MIRROR NUCLEI Mg^{25} AND Al^{25}. H. E Gove and A. E. Litherland (Atomic Energy of Canada, Ltd., Chalk River). Phys. Rev. 107, 1458-9(1957) Sept. 1.

Thirteen pairs of corresponding levels in the two nuclei, Mg^{25} and Al^{25}, are identified, and twelve of them were assigned both spins and parities. (M.H.R.)

507

SPIN AND MAGNETIC MOMENT OF P^{32} BY THE ELECTRON NUCLEAR DOUBLE-RESONANCE TECHNIQUE. G. Feher, C. S. Fuller, and E. A. Gere (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 107, 1462-4(1957) Sept. 1.

The small amplitude of the signal obtained at a frequency corresponding to the $(+\frac{1}{2},-1) \rightarrow (+\frac{1}{2},0)$ transition indicates that $\mu(P^{32})$ is negative. The spin value of 1 is consistent with Nordheim's strong coupling rule. (M.H.R.)

508

GROUND STATE AND EXCITED LEVELS OF Cl^{40}. Igal Talmi (Princeton Univ., N. J.). Phys. Rev. 107, 1601-2 (1957) Sept. 15.

A calculation to determine the level scheme of Cl^{40} is done by using matrix elements of the nuclear interaction determined from a previous analysis of nuclear energies. The value of the spin J = 2 obtained for the ground state is in agreement with experimental results. (auth)

509

TRANSITION ENERGIES AND NUCLEAR LEVELS IN Sm^{152}, Sm^{154}, Gd^{152}, AND Gd^{154} AS DERIVED FROM THE SEPARATED ISOTOPES OF EUROPIUM. J. M. Cork, M. K. Brice, R. G. Helmer, and D. E. Sarason (Univ. of Michigan, Ann Arbor). Phys. Rev. 107, 1621-5(1957) Sept. 15.

Specimens of highly enriched Eu^{151} and Eu^{153} were irradiated in the Argonne CP-5 reactor and the product isotopes studied in both magnetic and scintillation spectrometers. Eu^{152} decays by electron emission to Gd^{152} and by K capture to Sm^{152}. Eu^{154} emits beta particles leading to Gd^{154} but no evidence appeared for positron emission or K capture leading to Sm^{154}. The many conversion-electron lines together with coincidence data allowed the evaluation of the gamma transitions and their arrangement in plausible nuclear level schemes. The beta spectra were resolved by the use of the double-focusing spectrometer. Each of the daughter nuclei is even-even in structure. A comparison is made of the observed lower energy transitions and the prediction from the collective model for rotational states. (auth)

510

DECAY SCHEME OF Co^{62}. Donald G. Gardner and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Phys. Rev. 107, 1628-31(1957) Sept. 15.

A study of the decay of Co^{62} has been made using β- and γ-scintillation techniques. The Co^{62} was produced by a (d,α) reaction on nickel oxide enriched in Ni^{64}. A half life of 13.91 minutes with a calculated standard deviation of ± 0.05 minute was measured. Two beta groups of 0.88 ± 0.04 and 2.88 ± 0.03 Mev energy were found, with relative abundances of 25 and 75%, respectively. Both β-ray transitions appear to be allowed. Gamma rays of 1.17 ± 0.01, 1.47 ± 0.02, 1.74 ± 0.03, and 2.03 ± 0.03 Mev were measured, with relative percentages of 100% and 82% for each member of the 1.17-Mev doublet, and 18, 18, and 7% for the others, respectively. A much weaker γ ray with an energy of $\sim 2.5 \pm 0.2$ Mev and an intensity of less than 2% was also noted. A level scheme incorporating these data is presented. All energy errors are estimated standard deviations. (auth)

511

ISOTOPES OF BERKELIUM AND CALIFORNIUM PRODUCED BY NEUTRON IRRADIATION OF PLUTONIUM. T. A. Eastwood, J. P. Butler, M. J. Cabell, and H. G. Jackson (Atomic Energy of Canada, Ltd., Chalk River, Ontario) and R. P. Schuman, F. M. Rourke, and T. L. Collins (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 107, 1635-8(1957) Sept. 15.

Samples of Bk and Cf have been separated from neutron-irradiated Pu and carefully purified. Pure Cf^{249} daughter has been separated from the Bk^{249}. The Cf sample and its Cm decay products have been mass analyzed. The Bk fraction contained 314 ± 8 day Bk^{249} emitting 0.114 ± 0.015 Mev beta particles and 5.417 ± 0.015 Mev and 5.03 ± 0.03 Mev alpha particles. The α-β ratio was found to be $(2.2 \pm 0.3) \times 10^{-5}$. The Cf sample contained: 360 ± 40 year Cf^{249} emitting 5.808 ± 0.010, 5.93 ± 0.02, and 6.20 ± 0.02 Mev alpha par-

ticles; 10.9 ± 0.8 year Cf^{250} emitting 6.020 ± 0.010 Mev alpha particles; 800-year Cf^{251}; 2.55 ± 0.15 year Cf^{252} emitting 6.112 ± 0.015 Mev alpha particles; and 17 ± 1 day Cf^{253}. (auth)

512

DECAY OF Cr^{51}. S. Ofer and R. Wiener (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 107, 1639-41(1957) Sept. 15.

The spectrum of γ rays from Cf^{51} was examined, including the spectrum in coincidence with the strong 325-kev γ ray. The shape and intensity of the internal bremsstrahlung spectrum accompanying the K-capture transition to the ground state was found to be in fair agreement with theory as also was, within the experimental error, the intensity of the internal bremsstrahlung accompanying the K-capture decay to the 325-kev level. Two very weak γ transitions of energies 320 and 645 kev and of intensities 10^{-5} and 5×10^{-4} per disintegration, respectively, were found, the former in cascade with the main 325-kev transition. (auth)

513

SINGLE ELECTRON SHAKEOFF PROBABILITY FOLLOWING THE BETA DECAY OF KRYPTON. Alex E. S. Green (Florida State Univ., Tallahassee). Phys. Rev. 107, 1646-50(1957) Sept. 15.

In view of the experimental work of A. H. Snell and F. Pleasonton, which indicates that the product atom following the beta decay of krypton is frequently left in high states of ionization, it is of interest to attempt a calculation of shakeoff probabilities for all the outermost occupied configurations. The method of calculation used here essentially follows the formulations of A. Migdal, E. L. Feinberg, J. S. Levinger, H. M. Schwartz, and earlier workers. The details of the calculations are governed to a considerable extent by the availability of Rb^+ Hartree wave functions. The innovations which are attempted here involve the use of newly determined analytical approximations to Hartree functions, the use of a simple scaling technique, and the extension of the work to the outermost occupied levels. Comparisons of the calculated shakeoff probabilities with those inferred from experiment by Snell and Pleasonton are made. The agreement is fairly satisfactory. It is believed that some of the innovations used here might be useful for other types of atomic calculations. (auth)

514

ATOMIC MASSES OF H^1, C^{12}, AND S^{32}. K. S. Quisenberry, C. F. Giese, and J. L. Benson (Univ. of Minnesota, Minneapolis). Phys. Rev. 107, 1664-7(1957) Sept. 15.

The Minnesota 16-inch double-focusing mass spectrometer has been used to measure a series of mass doublets which enable one to calculate the atomic masses of H^1, C^{12}, and S^{32}. The doublet $\frac{1}{2}C_4H_4O - H_2O_2$ is used to relate the C^{12} mass directly to that of the O^{16} standard. Recent tests of the instrument and its calibration give confidence in the reliability of the present results. The resulting mass values are H^1 = 1.008 1451 ± 2, C^{12} = 12.003 8156 ± 4, and S^{32} = 31.982 2388 ± 9 amu. These values differ from the previously reported results by more than the published errors might lead one to predict. However, in no cases do the changes reflect a significant change in previously published atomic masses. (auth)

515

SEARCH FOR MONOPOLE PAIRS FROM THE SECOND EXCITED STATE OF C^{12}. G. Goldring and Y. Wolfson (Weizmann Inst. of Science, Rehovoth, Israel) and R. Wiener (Hebrew Univ., Jerusalem, Israel). Phys. Rev. 107, 1667-8(1957) Sept. 15.

A thorough search for monopole pairs from the second excited state in C^{12} is described. No pairs could be detected and it is concluded that the question of the angular momentum and parity of this state cannot yet be considered as solved. (auth)

516

NEUTRON SEPARATION ENERGIES AND PAIRING ENERGIES FOR HEAVY NUCLEI. W. H. Johnson, Jr. and V. B. Bhanot (Univ. of Minnesota, Minneapolis). Phys. Rev. 107, 1669-73(1957) Sept. 15.

A six-inch double-focusing mass spectrometer has been employed to determine 32 mass differences between neighboring isotopes of even-Z elements in the region Z = 64 to 82. Neutron separation energies and neutron pairing energies are easily calculated from the experimental results. These calculated values are sufficiently precise to conclude that lack of uniformity in neutron separation energy and pairing energy systematics appears in regions where other nuclear properties exhibit changes in their systematics. Neutron separation energy data have also been employed for the isotopic assignments of several nuclear reactions. (auth)

517

LIFETIME MEASUREMENTS BY CONVERSION LINE SHIFT: LIFETIME OF THE 40-kev STATE OF Tl^{208}. J. G. Siekman and H. de Waard (Univ. of Groningen, Netherlands). Phys. Rev. 107, 1731(1957) Sept. 15.

The value $T_{\frac{1}{2}} \approx 4 \times 10^{-12}$ sec was found, which gives $\tau_\gamma \approx 180 \times 10^{-12}$ sec. (M.H.R.)

518

POLARIZED POSITRONS FROM Ga^{66} AND Cl^{34}. M. Deutsch, B. Gittelman, and R. W. Bauer (Massachusetts Inst. of Tech., Cambridge) and L. Grodzins and A. W. Sunyar (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 1733-4(1957) Sept. 15.

Positrons emitted by Ga^{66}, which is probably a pure Fermi transition, are polarized in their directions of motion ($\sigma \cdot p$ positive). Preliminary results for the pure Fermi transition of Cl^{34} also indicate the same sign for ($\sigma \cdot p$). (M.H.R.)

519

NUCLEAR TOTAL CROSS SECTIONS FOR 350 Mev NEUTRONS. A. Ashmore, R. G. Jarvis, D. S. Mather, and S. K. Sen (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 745-55(1957) Oct.

Measurements have been made of the total cross sections of a number of elements for neutrons with a mean energy of 35.5 ± 2.0 Mev. The measured cross sections in mb are given for C, O, Al, Cu, Sn, Pb, H, D, and n. A comparison with previous measurements shows that the total cross sections of complex nuclei remain constant within the experimental error 1% between neutron energies of 270 Mev and 380 Mev. At 410 Mev they have risen significantly due to meson production. (auth)

520

THE β-SPECTRUM OF SULPHUR 35. R. D. Connor and I. L. Fairweather (Univ. of Edinburgh). Proc. Phys. Soc. (London) A70, 769(1957) Oct.

For energies greater than 100 kev, the uncorrected Fermi plot for each of several runs on S^{35} was linear within the limits of statistical accuracy, which was everywhere better than 1%. Taking the results as a whole, the end point energy was determined to be 167.4 ± 0.2 kev. This end point energy yields a log ft value of 5.01 for 87.1 day S^{35} and corresponds to a mean β-particle energy of 61.0 ± 0.2 kev. (M.H.R.)

521

THE ODD-PARITY STATES OF ^{16}O AND ^{16}N. J. P. Elliott and B. H. Flowers (Atomic Energy Research Establishment, Harwell, Berks). Proc. Roy. Soc. (London) A242, 57-80(1957) Oct. 8.

The properties of the odd-parity states of O^{16} and N^{16}

have been calculated insofar as they may be considered to arise from the configurations p-^{1}d and p-^{1}2s. The calculations were performed in intermediate coupling, including the spin-orbit splittings of the p and d shells, and full account was taken of the mixing of the two configurations. A satisfactory picture can be given of the known odd-parity levels of both nuclei, although some anomalous features, apparently associated with the detailed nature of nuclear forces, remain without full explanation. Some remarks are made regarding the photodisintegration of oxygen and it is found that the shell model can account satisfactorily for the observed photon widths which constitute the giant resonance. (auth)

522

THE COHERENT SCATTERING OF γ-RAYS BY K ELECTRONS IN HEAVY ATOMS. IV. THE SCATTERING OF 1.28 AND 2.56mc^2 γ-RAYS IN MERCURY. G. E. Brown (Univ. of Birmingham, Eng.) and D. F. Mayers (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London) A242, 89-95 (1957) Oct. 8.

The results of calculations for the coherent scattering of γ ray of energies 1·28 and 2·56 mc^2 are given in the form of scattering amplitudes as functions of angle. Cross-sections computed from these are compared with the experimental data for scattering by lead, and the evidence for Delbrück scattering is discussed. (auth)

523

AN OPTICAL NUCLEAR MODEL FOR NEUTRON REACTION CROSS SECTIONS. P. Mittelstaedt. Z. Naturforsch. 12a, 643-6(1957) Aug. (In German)

524

THE γ-γ ANGULAR CORRELATION OF THE REACTION $Be^9(\alpha,n\gamma\gamma)C^{12}$ AND THE SPIN OF THE SECOND EXCITED STATE OF C^{12}. K. G. Steffen and H. Neuert. Z. Physik 147, 125-31(1957). (In German)

525

THE 208/113 Kev γ-γ CASCADE OF Hf^{177}. K. G. Steffen. Z. Physik 147, 132-40(1957). (In German)

526

THE ELASTIC SCATTERING OF GAMMA RAYS AT SMALL ANGLES. Herwig Schopper. Z. Physik 147, 253-60(1957). (In German)

527

MEASUREMENT OF POLARIZATION OF β PARTICLES OF Sr^{90} + Y^{90}. Joachim Heintze. Z. Physik 148, 560-3(1957). (In German)

A simple method for the measurement of the polarization of β particles is described. The β particles were first deflected at about 30° by multiple scattering and then elastically and inelastically scattered on a Pt foil. The asymmetry of the scattering was investigated. (auth)

Nuclear Reactors

Refer also to abstracts 3, 6, and 7.

528 57-GL-10

General Electric Co. General Engineering Lab., Schenectady, N. Y.

ANALOG COMPUTER STUDY OF THE TRANSIENT PERFORMANCE OF A DUAL CYCLE BOILING WATER REACTOR NUCLEAR POWER PLANT. David W. Leiby. Jan. 15, 1957. 27p.

529 AERE-C/M-320

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EXPERIMENTS ON ORGANIC URANIUM AND THORIUM COMPOUNDS AS POSSIBLE REACTOR FUELS. Alan E. Comyns. July 1957. 9p.

Requirements for a homogeneous organic reactor fuel are discussed. Dibenzoylmethane complexes of U and Th fulfil some of these requirements, they are soluble in terphenyls and very stable to radiation, but their thermal stabilities are insufficient for a reactor fuel. (auth)

530 AERE-E/R-1245

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ANALYSIS OF POWER, TEMPERATURE AND REACTIVITY TRANSIENTS IN B.E.P.O. D. V. Wordsworth. Sept. 1953. Decl. Mar. 1957. 21p.

AERE-R/R-1980 revised version.

A method is developed of calculating pile power and component temperatures in a pile of the BEPO type, following a sudden increase in reactivity by rapid withdrawal of the control rods. Comparison of three sets of experimental results, taken on BEPO with the corresponding theoretical results found by this method, shows that agreement is fair for the whole transient and is good for the points of maximum pile power and maximum U temperature, reached during the transient overshoots. It is suggested that time lags in recording pile power and temperatures account for some of the discrepancy between theory and experiment, and this is illustrated on the early part of the pile divergence where theory is well established. An over-all temperature coefficient of reactivity is found, suggesting that reactivity decreases 1.60 millimiles per degree rise in U maximum temperature. The results of the analysis confirm Sterry's heat transfer coefficients found on rig tests with BEPO helically finned slugs. (auth)

531 AERE-R/R-2248

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOLUTION OF THE PILE EQUATION FOR A BARE CYLINDRICAL SYSTEM OF HEXAGONAL CROSS-SECTION. K. C. Hines and D. W. Holbrough. Apr. 1957. 9p.

It is shown that the diffusion equation for a cylindrical reactor with hexagonal cross-section may be solved as an infinite series, the terms of which involve Bessel functions of order 6n, where n = 0, 1, 2, ... for the successive terms of the series. Considering in succession additional terms of the series a sequence is obtained for the eigenvalue which converges rapidly. In this way a value is found for the eigenvalue of a bare system. The contour of zero flux was evaluated in the approximations for which one, two ....., terms of the series solution were included. When three terms are included this contour of zero flux was found to follow the hexagonal boundary quite closely. (auth)

532 ANL-5678

Argonne National Lab., Lemont, Ill.

MANUFACTURE OF THE ThO_2–UO_2 CERAMIC FUEL PELLETS FOR BORAX-IV. J. H. Handwerk, C. L. Hoenig, and R. C. Lied. Aug. 1957. 20p. Contract W-31-109-eng-38. $0.75(OTS).

Preliminary investigation indicated that it was possible to prepare thoria–urania solid solutions by sintering in air a mixture of ThO_2 and U_3O_8. The U_3O_8 on heating in air was found to disassociate, and when heated with ThO_2, the resultant body was essentially a ThO_2–UO_2 solid solution. The methods used in preparing and granulating the ThO_2 and U_3O_8 for the BORAX-IV loading are discussed in detail. This material was dry pressed using pressures from 13,000 to 15,000 psi. The pressed pellets were loaded into alumina crucibles and fired to a peak temperature of 1700°C to 1750°C. The fired ware was found to have an average ap-

parent density of 9.8 g/cc. The pellets were loaded into Al–1 wt. % Ni tube plates and the annulus between the pellet and the tube was filled with lead. After closing the open end of the tube plates, the plates were spot welded into a subassembly. (auth)

533 ANL-5720
Argonne National Lab., Lemont, Ill.
PERFORMANCE AND POTENTIAL OF NATURAL CIRCULATION BOILING REACTORS. W. S. Flinn and M. Petrick. Oct. 1957. 46p. Contract W-31-109-eng-38. $1.25(OTS).

A parametric study of the potential and performance of natural circulation boiling nuclear reactors is presented. Analyses are based on engineering data and correlation extrapolations obtained from boiling studies at Argonne. Graphs are used extensively to show interrelationships of power density, system pressure, average core coolant density, core height, riser height, channel hydraulic diameter, recirculation flow rate, and exit steam volume fraction. Interesting aspects of reactor design and their effects on performance are discussed briefly. (auth)

534 APAE-20
Alco Products, Inc., Schenectady, N. Y.
LONG-LIVED CIRCULATING ACTIVITY IN THE ARMY PACKAGE POWER REACTOR. W. J. Small, J. L. Zegger, and A. L. Medin. Aug. 28, 1957. 25p. Contract AT(11-1)-318. $1.00(OTS).

The radioactivity in the circulating water of the Army Package Power Reactor has been analyzed for long-lived nuclides. Long-lived nuclides resulting from (n-γ) and (n-p) reactions on the cladding and/or structural materials were found. The rate of accumulation and the interrelationship of these nuclides are discussed. (auth)

535 ASAE-S-3
American-Standard. Atomic Energy Div., Redwood City, Calif.
AN EVALUATION OF HEAVY WATER REACTORS FOR POWER. D. P. Herron, W. H. Newkirk, and A. Puishes. Oct. 1, 1957. 211p. Contract AT(04-3)-109. $5.50(OTS).

Reference designs for pressurized and direct-boiling D_2O reactors were prepared for electrical outputs of 20, 100, and 250 electrical Mw. A number of possible core designs were considered and those utilized which seemed most appropriate to give low-cost power. The technology and costs available today were employed in the preparation of the over-all plant designs. The Consolidated Western Steel Division of U. S. Steel Corporation assisted by preparing a comprehensive report on the design of large pressure vessels and containment vessels. Zr-clad U fuel elements were used as the study basis, but the effect of using UO_2 and stainless steel cladding was also considered. The principal results found were: (1) Over a wide range of operating conditions and economic situations, enriched U (up to perhaps 1.4% U^{235}) is presently more economic to employ in D_2O reactors than is natural U. (2) In the longer range, the use of natural U may become more economic as Zr fabrication costs decrease, continuous charge-discharge devices are developed to permit longer exposure levels, and pressure-vessel technology advances so that the large critical masses and core diameters required are not such an economic penalty on the natural U. The results agree quite well with the data and discussions of the Canadians. (auth)

536 CF-55-5-156(Rev. IV)
Oak Ridge National Lab., Tenn.
HRT PROCESS FLOWSHEETS (REVISION IV). F. C. Zapp. Sept. 16, 1967. 18p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The first four process flowsheets were drawn to show the division between the high and low pressure fuel and blanket systems. This necessitated the repetition of certain equipment which fell at the dividing points, such as the letdown heat exchangers, the feed pumps, etc. They were also designed to make it possible to cut the sheets and join them to make one large flowsheet without repetition of equipment or lines. In general the flowsheet line numbers on the fuel side are a 100 series and the corresponding lines on the blanket side are in a 200 series; i.e., lines 102 and 202 will have the same function in their respective systems. (auth)

537 CF-55-9-167
Oak Ridge National Lab., Tenn.
TWO-GROUP CALCULATIONS FOR A STEEL–WATER CRITICAL EXPERIMENT AND THE APPR. J. G. Gallagher. Sept. 28, 1955. Decl. Sept. 1957. 20p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Two-group constants have been prepared for a range of steel-water volume ratios. A calculation of critical mass and flux distribution has been made for an existing steel-water critical experiment. In order to check the experimental critical mass the age was increased. The effect of this adjustment on flux distribution was noted. The critical mass and flux distribution were calculated for the clean APPR critical experiment using the adjusted curve of age vs steel-water volume ratio. The calculated critical mass of the clean APPR critical experiment was 9.04 kg of U^{235}. (auth)

538 CF-57-1-164
Oak Ridge National Lab., Tenn.
POWER DISTRIBUTION OF TOWER SHIELDING FACILITY REACTOR (TSR). W. G. Blessing. Jan. 17, 1957. 9p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

The horizontal and vertical power distribution for a 5 × 7 fuel element loading of the TSR is presented. (auth)

539 CF-57-7-92
Oak Ridge National Lab., Tenn.
ANALYSIS OF BORAX EXPERIMENTS. M. C. Edlund and L. C. Noderer. 1955. Reissued July 19, 1957. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

An analysis of the self-limitation of power excursions by steam production in heterogeneous water-moderated reactors using MTR- type fuel elements seems to give excellent agreement with Borax data on both fuel plate temperature rise and total energy for excursions in which the reactor is initially at saturation temperature. A simple model for steam production is developed from thermodynamic and heat diffusion considerations. In those cases for which the reactor is substantially sub-cooled, it appears that for MTR fuel elements, at least, all the water in the coolant channels at the hottest part of the reactor must be heated to saturation temperature before steam is produced. The theory is used to discuss the safety merits of research reactors which differ in neutron generation time, steam void coefficients and hydrodynamic characteristics. It is shown that D_2O reactors of the CP-5 type, because of their long neutron lifetime, can safely self-limit power excursions resulting from much larger reactivities than can the H_2O reactors of the swimming pool type. On the other hand, the response of the two reactor types to equivalent accidents, such as the addition of a given amount of fissionable material, is practically the same. (auth)

540 CF-57-9-59
Oak Ridge National Lab., Tenn.
DECONTAMINATION OF A HOMOGENEOUS REACTOR. (Presented at American Nuclear Society Meeting, Pitts-

burgh, Pa., June 10-12, 1957.) R. D. Baybarz. Sept. 9, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

A satisfactory method of decontaminating a homogeneous reactor was developed using a $CrSO_4-H_2SO_4$ solution to dissolve and remove the oxide corrosion film deposited on stainless steel from UO_2SO_4 solutions at 300°C. Investigations show that Pu and fission products are incorporated in the oxide film and that descaling of the corrosion film is necessary for adequate decontamination. The 0.40 M $CrSO_4$–0.5 M H_2SO_4 solution gave excellent film removal by modifying and dissolving the oxides, together with excellent decontamination from Pu and fission products in 2 to 4 hrs at 80 to 90°C. The decontamination is a result of dissolution of the oxide film, so that the contaminants go into solution and are removed in the spent $CrSO_4$ solution. (auth)

541 CF-57-9-67
Oak Ridge National Lab., Tenn.
BLANKET RECOMBINER PERFORMANCE TEST HRT TEST IV A, 35a. Work Period: June 25, 1956 to June 28, 1956. H. E. Williamson. Sept. 10, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

Off-gas samples obtained during operation of the blanket recombiner at hydrogen flow rates between 0.2 and 2.0 scfm indicated complete recombination with excess oxygen of 0.1 scfm and a steam dilution of 2 lb/min. The catalyst bed temperature varied linearly with hydrogen flow rate from 165°C at 0.2 scfm to 290°C at 2.0 scfm. (auth)

542 CF-57-9-68
Oak Ridge National Lab., Tenn.
FUEL EXPOSURES IN URANIUM–THORIUM REACTORS WITH BORIC-ACID CONTROL. R. Benumof and C. W. Nestor, Jr. Sept. 23, 1957. 18p. $3.30(ph OTS); $2.40 (mf OTS).

The reactivity lifetimes of a U-Th slab reactor, 20 feet thick, and of a spherical reactor, 20 feet in diameter, were calculated for Th concentrations of 100 and 200 g per l. For Th concentrations of 100 g/l, exposures of about 5000 Mwd/t appears possible. The reactors were kept critical by modifying the concentration of H_3BO_3 in a control region. The results for a slab reactor indicate that increasing the Th concentration from 100 to 200 g/l increases the maximum possible fuel exposure by a factor of three and increases the fissionable-fuel concentration by a factor of 2.2. Furthermore, for Th concentrations greater than 100 g per l, there is a large initial increase in the H_3BO_3 concentration required to keep the reactor critical; control of the reactor by this means alone may not be feasible, since the reactivity control associated with the addition of poison to the control region decreases as the acid concentration increases. Clearly, if the control region is initially "black" to neutrons, no additional reactivity decrease can be gained from additional poison in the control region. The results for the spherical reactor are in good agreement with those for the slab reactor. In addition, the results for the spherical reactor containing 100 g Th/l indicate that if the initial poison concentration were raised so as to require an increase of 1% in the initial fissionable-fuel concentration, the accompanying increase in exposure would be about 1500 Mwd/t. (auth)

543 CF-57-9-92
Oak Ridge National Lab., Tenn.
REACTIVITY LIFETIMES WITH NON-UNIFORM BURNUP. Albert Fromhold, Jr. Sept. 27, 1957. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

An approximation to non-uniform fuel burnup is obtained by dividing the reactor into a number of regions and assuming that burnup is uniform in each region. A modified one-group calculation is performed on a two-region graphite-moderated reactor that has a radius of 10.3 ft. The concentration of natural U is 389 g/l, which is equivalent to a 1.37-inch diameter cylindrical fuel rod in an $8\frac{3}{4}$-inch lattice. Considering resonance effects, a lifetime of 6,500 Mwd/ct is obtained. If resonance effects are neglected, a lifetime of 4,500 Mwd/ct is obtained. Further study of natural-U fueled reactors through this procedure can show the effects of varying the size and initial fuel concentration on the reactor lifetime. (auth)

544 CF-57-9-95
Oak Ridge National Lab., Tenn.
PERMISSIBLE EXPOSURES OF U^{233}–THORIUM FUEL ELEMENTS IN REACTORS HAVING CONTINUOUS FUEL FEED. B. E. Prince. Sept. 30, 1957. 33p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Support is given to the conclusion that use of the continuous-irradiation fuel cycle increases the reactivity lifetime over that of uniformly-loaded, batch-irradiated systems. The reactor was assumed to have the general characteristics of a large, one-region system, with a horizontal lattice of Th–U^{233} rods, surrounded by D_2O at 250°C. Two loading programs were considered as limiting cases. The first was one in which fuel rods were continuously charged at both faces of the reactor, passed through, and discharged at the opposite faces, the fuel rods in adjacent channels moving in opposite directions. For this case it was found that for exposure lifetimes as large as 20,000 Mwd/t and above, the neutron flux pattern remains the same as in a uniformly-loaded reactor. In the second program, fuel rods were considered to be loaded at one face, advanced through all channels in the same direction, and discharged from the opposite face. Comparison graphs of the exposure lifetimes attained with these programs, as a function of reactor size (length of channel), Th concentration, and initial breeding ratio are given. In these figures, the difference between the upper and lower curves also gives an estimate of the magnitude of correction associated with flux depressions within the channels. The reactivity lifetime for the case of alternate-pass of fuel was twice that of a fixed-fuel, batch-irradiated system, with the same initial fuel loading. It was assumed that there were no Pa^{233} losses, no structural poisons, and no fast fissions in Th. (auth)

545 CF-57-9-98
Oak Ridge National Lab., Tenn.
TEST OF HRT RECOMBINERS. B. A. Hannaford. Sept. 20, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Tests of the HRT fuel and blanket recombiners at several gas concentrations and steam rates disclosed satisfactory efficiency at approximately design conditions. At lower gas concentrations and steam flow rates a small recombiner downstream from the condenser is necessary to maintain 100% recombination. It is recommended that the platinized catalyst in the fuel and blanket HRT recombiners not be replaced, and that a small recombiner be installed in the 1-in. off-gas line from each recombiner condenser. (auth)

546 CF-57-10-77
Oak Ridge National Lab., Tenn.
TEST OF KOBY OIL FILTER ON HRT SHIELD VACUUM PUMPS, HRT TEST X.C. 5.c. S. I. Kaplan. Oct. 16, 1957. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80 (mf OTS).

547 CRDC-730
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A COBALT IRRADIATION MONITORING TECHNIQUE AND SOME MEASUREMENTS OF THERMAL NEUTRON

DENSITIES IN THE NRX REACTOR. R. E. Jervis. Sept. 1957. 55p.

The measurement of absolute thermal neutron densities in various irradiation positions in the Chalk River NRX reactor is described. A cobalt wire irradiation monitoring technique has been developed that permits semi-routine measurements to be made readily with high precision (±0.3%). Results are reported for thermal flux measurements in NRX lattice positions, self-serve irradiation facility, J-rod annulus, an experimental hole and an in-reactor fuel irradiation test. (auth)

548 CRRP-714

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PREDICTED CHARACTERISTICS OF PTR WITH HEAVY WATER THERMAL COLUMN. G. L. Keech. July 29, 1957. 28p. (AECL-477).

The critical masses, the fast and slow neutron flux distributions, and the fast and slow adjoint functions are calculated for Pool Test Reactor having D_2O thermal columns of 7 different diameters, 3 with a central H_2O column. The sensitivities of PTR to fissionable samples, and absorbers as well as the mean lifetimes of the neutrons are determined for the different size thermal columns. (auth)

549 HW-51181

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

HYDRAULIC CHARACTERISTICS OF PRPR FUEL ELEMENTS: 19-ROD CLUSTER. Interim Report. D. R. Doman. June 28, 1957. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

550 HW-51741 A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT [FOR] JULY 1957. F. W. Albaugh, V. R. Cooper, and P. F. Gast. Aug. 10, 1957. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Progress is reported briefly in development of fuel elements, material instrumentation, and mechanical equipment for the PRPR. (For preceding period see HW-51234 A-2.) (W.L.H.)

551 HW-51751

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE FAST FLUX DISTRIBUTION IN AN EMPTY PROCESS TUBE FOR VARIOUS SIZES OF GRAPHITE REACTOR LATTICE. J. Martin Tobin. Aug. 12, 1957. 23p. Contract W-31-109-Eng-52. $0.75(OTS).

Equations are presented that can be used with fast flux monitors to determine the fast flux distribution in an empty process tube for a radiation damage experiment. (W.L.H.)

552 HW-52048

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THERMAL UTILIZATION, THERMAL FLUX, AND LATTICE CELL SHAPE. H. Neumann. Aug. 19, 1957. 50p. Contract W-31-109-Eng-52. $1.50(OTS).

Quantitative criteria are established to show that the propagated effect of a fuel rod in a lattice will be cylindrically symmetric if the lattice symmetry is high, if the lattice spacing is small compared with the moderator diffusion length, or if the fuel rod diameter is small compared with the lattice spacing. One or more of these conditions are ordinarily well met for D_2O and graphite lattices and for filled hexagonal (60° rhombic) H_2O lattices. Provided the propagated effect of a fuel rod is cylindrically symmetric, it is shown that the thermal utilization of a lattice array can be calculated exactly. Such a calculation involves the sum of a lattice array of zero order, modified Bessel functions of the second kind (i.e., K_0), and exact formulas for such sums valid for arbitrary diffusion length and lattice spacing are given for rectangular, open hexagonal, square, and filled hexagonal lattices and for the linear chain, by a refinement of the method of Galanin. For square and filled hexagonal D_2O and graphite lattices and for filled hexagonal H_2O lattices thermal utilizations so calculated differ only slightly from those provided by the usual equivalent cylindrical model. The Bessel function lattice sum technique is shown to provide accurate moderator flux traverses appreciably more easily than does a direct trigonometric series solution, since even the lowest order terms meet the cell boundary conditions exactly. The normalization of the Green's function for an infinite array of sink rods is shown to depend upon the radius of the rods and upon their proximity. If the rod radius vanishes, the Green's function reduces to the usual line sink approximation. (auth)

553 HW-52274

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ENERGY GENERATION AND FISSIONABLE ISOTOPE DISTRIBUTION AS A FUNCTION OF THE RADIUS FOR FUELS AT HIGH EXPOSURE. E. R. Astley. Aug. 27, 1957. 13p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Equations were derived giving the spatial distribution of fissionable isotopes as a function of exposure. These are then used to calculate the energy generation in a fuel element as a function of radius and exposure. The results plotted show that the energy generation varies from a simple I_0 dependence on radius at low exposures toward uniform energy generation at high exposures (10,000 Mwd/t). (auth)

554 HW-52343

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TEMPERATURE DISTRIBUTION IN A FUEL ELEMENT AS A FUNCTION OF EXPOSURE. E. R. Astley and A. G. Schwartz. Sept. 3, 1957. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A 1.34 inch diameter solid U fuel element operating at a specific power of 50 kw/ft was chosen as the study model. Results show that the central temperature of this fuel element at constant specific power increases from 435 to 453°C in progressing from 0 to 8000 Mwd/t exposure. An assumption of constant heat generation yields a central temperature of 483°C. Since conductivity is only known at best to within 10% for irradiated U, it is suggested that an assumption of constant energy generation always be used in design studies to provide for some conservatism until more accurate data are obtained. (auth)

555 IDO-16393

Phillips Petroleum Co. Atomic Energy Project. Idaho Falls, Idaho.

AN ELEMENTARY MODEL FOR REACTOR BURST BEHAVIOR. G. O. Bright, S. G. Forbes, W. E. Nyer, and F. Schroeder. Aug. 2, 1957. 12p. $3.30(ph OTS); $2.40 (mf OTS).

Originally issued as an internal memorandum PPC-215, July 1955.

An elementary model for the description of reactor transient behavior is presented. Work initially done by Fuchs and later by Weinberg and Ergen was extended to include a correlation between transient pressures and the rate of change of power. A modification of the above

equations is made to take into account an elementary hydrodynamical consideration. The situation where the shutdown coefficient has an energy release threshold is discussed. (auth)

556 IGR-TM/W-057

Gt. Brit. Windscale Works, Sellafield, Cumb., England.
DEFLECTION OF FINS IN CALDER REACTORS. W. B. Hall. May 16, 1956. 7p. (IGC-NPCC-FEWP/P-56).

Both the heat transfer and pressure drop characteristics of the Calder reactor fuel elements have been found to be markedly affected by a slight bowing of the fins. It is shown that there will be no significant creep deflection of the fins in the Calder reactor as a result of stress imposed by the coolant flow. (M.H.R.)

557 IGR-TN/C-632

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
POSSIBLE MECHANISMS OF FAILURE OF CARBON DIOXIDE COOLED REACTOR PRESSURE VESSELS. T. J. Heal, B. Watkins, and A. Cowan. Oct. 1957. 7p.

The factors likely to cause failure of reactor pressure vessels are discussed, distinguishing those which may occur prior to service from those which may occur during service. It is concluded that no single factor is of paramount importance. Failure during service would cause greater concern and, accordingly, overriding consideration may have to be given to factors (creep, high temperature ductility, metallurgical stability, effects of irradiation and fatigue) likely to lead to failure at this stage. (auth)

558 IGR-TN/R-254

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
REVISED LATTICE CONSTANTS FOR THE CALDER HALL THERMAL REACTORS. B. Cutts. Oct. 1955. 21p. (IGC-TRDC/P-125; IGC-TRSWP/R-20).

The revised values of the lattice constants for the Calder Hall Thermal Reactors are given together with additional information relevant to the conditions during startup. (auth)

559 KAPL-1803

Knolls Atomic Power Lab., Schenectady, N. Y.
QUARTERLY REACTOR TECHNOLOGY REPORT NO. 2 [FOR] APRIL, MAY, JUNE 1957. 68p. Contract W-31-109-Eng-52. $1.75(OTS).

Additional neutron distribution studies were made using both spiked and unspiked U–polyethylene assemblies. Calculations of energy distributions of inelastically scattered fission neutrons were extended to Al, Ni, Cr, Fe, and Zr. A 704 digital computer program, SPY, developed for simulating the transient behavior of a two-pass pressurized water reactor is described. Neutron spectrometer studies of U^{233} included eta studies from 1 to 30 ev, studies of fission neutron count vs energy, and total cross section measurements. A flow study was conducted on a half-scale model of a reactor inlet plenum to determine the effects of baffles on eddies and vortices. The results indicate the flow distribution improvement with baffles is not worth the pressure drop penalty of 5 psi. Further studies of the heat transfer characteristics of twisted ribbon fuel elements are reported. Post-irradiation bend test results are presented which indicate the effects of radiation on dispersion-type control materials. The materials tested were Eu_2O_3–stainless steel, Gd_2O_3–Ti, and Gd_2O_3–stainless steel. Tables of Hf physical properties and corrosion behavior in water are given, and melting and fabrication methods developed for Hf are outlined. Development of composite control rods, Hf–TiB^{10} dispersion–Ti–Ti clad, was continued with studies of fabrication, metallurgical properties, corrosion properties, and neutron absorption. Initial studies of the effects of coolant flow rates on the deposition of corrosion products on fuel elements in pressurized water reactors are reported. (For preceding period see KAPL-1770.) (D.E.B.)

560 KAPL-M-EDL-126

Knolls Atomic Power Lab., Schenectady, N. Y.
INVESTIGATION OF A MERCURY SEAL FOR S1G VERTICAL SHAFT APPLICATION. D. F. Wood. May 17, 1957. 18p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

An investigation was conducted to determine the feasibility of utilizing a Hg seal for the S1G control plug drive shaft. The results indicated that a Hg seal would provide a satisfactory gas seal for this vertical shaft applications. However, the seal was ruled undesirable because of the hazards involved in using Hg in a confined area. (auth)

561 KAPL-M-EDL-127

Knolls Atomic Power Lab., Schenectady, N. Y.
O-RING TESTS S1G/S2G. D. F. Wood. June 28, 1957. 24p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70 (mf OTS).

An investigation was conducted to determine the operating characteristics and limits and the optimum use conditions of O-Ring seal on the S1G/S2G control plug shaft. The average leak rate on the life test of a prototype S1G/S2G O-Ring seal assembly varied between 0.005 and 0.010 cc per hour STP during operation in a temperature range of 70°F and 150°F with a pressure differential of 40 psig. Separate investigations were made on O-Rings to determine the optimum conditions of the various seal components such that the leak rate and operating torque would be a minimum. Within the scope of the investigation, it was found that the performance of the S1G/S2G seal as designed could not be significantly improved by changes in components. (auth)

562 LA-2141

Los Alamos Scientific Lab., N. Mex.
BERYLLIUM-REFLECTED, GRAPHITE-MODERATED CRITICAL ASSEMBLIES. G. E. Hansen, J. C. Hoogterp, J. D. Orndoff, H. C. Paxton, P. G. Koontz, W. H. Roach, and D. P. Wood. July 1957. 61p. Contract W-7405-eng-36. $1.75(OTS).

Included are data on the properties of three sets of cylindrical Be-reflected, graphite-moderated critical assemblies that have been set up in the Honeycomb machine. The first set was primarily to establish characteristics as functions of C/U^{235} atomic ratio of a core with nearly constant reflector thickness. Fission rates were mapped with U^{235} foils, and reactivity contributions of some foreign materials were measured. The second set consisted of three assemblies with fixed cores to determine the effect of redistributing reflector from the ends to the cylindrical wall. Flux distributions in the basic fully-reflected assembly were mapped extensively with bare and with Cd-shielded foils of U^{235}, Au, and In. The third set was to establish the minimum-volume core at $C/U^{235} \sim 350$ that could be made critical with available Be. Influences of end reflector and of a Be island were checked. (auth)

563 NARF-57-43T

Convair, Fort Worth, Tex.
REACTOR FUEL ELEMENT INSPECTION. P. L. Marjon. Oct. 1, 1957. 64p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-170).

Fuel elements from the Aircraft Shield Test Reactor and the Ground Test Reactor were inspected to determine physical condition and corrosion damage. Although several types of corrosion were in evidence, no fission product activity was detectable on the fuel elements. Procedures

were developed which included transportation, visual inspection, photography, corrosion sampling, and surface casting. The results of the inspections are presented and the methods and equipment used are evaluated. (auth)

564 NP-6445

Kernreaktor Bau-und Betriebs-Gessellschaft m.b.H., Karlsruhe, Germany.

PHYSIKALISCHE GESICHTSPUNKTE BEIM ENTWURF EINES FORSCHUNGSREAKTORS MIT NATÜRLICHEM URAN ALS BRENNSTOFF UND SCHWEREM WASSER ALS MODERATOR UND KÜHLMITTEL. (Physical Aspect of the Plan of a Research Reactor with Natural Uranium as Fuel and Heavy Water as Moderator and Coolant.) W. Hafele and K. Meetz. Feb. 28, 1957. 58p.

The core of a research reactor with natural U as fuel and D_2O as moderator and coolant is discussed. The U is arranged in solid rods (radius a) in a quadratic lattice (spacing $d = \sqrt{\pi}\, b$; b = radius of Wigner-Seitz' unit cell). The reactor core is also cylindrical (radius R_w, height l_w). Radial (r) and vertical (z) reflecting media are situated so they give a reactor economy δr (with respect to) δz. The problem consists in the determination of the seven reactor parameters W, R_w, l_w, δr, δz, a, b, (W = fission power). The determination results from the principle ϕ^{max} (W, R_w, l_w, δr, δz, a, b) as large as possible, where ϕ^{max} is the maximum thermal neutron flux in the center of the reactor. Then the assembly preparation admits of a fixed reactivity reserve ΔK as a quantitative secondary condition. It is possible to solve the extreme problem relative to every lattice structure (a,b) by a fixed standard power $W = W^*$. In the (a,b) plane, the curve of the solution $\phi^{max}(a,b) = \text{const.}$ can be plotted. One makes specific assumptions about the D_2O cooling so a set of curves $T_{max}(a,b) = \text{const.}$ can be gotten where T_{max} is the maximum surface temperature of the Al shell. Finally, the prepared graphs are discussed in detail. (M.H.R.)

565 NURG/M-48

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TEMPERATURE TRANSIENTS IN PIPPA DURING THE INITIAL STAGES OF DIVERGENCE. D. V. Wordsworth. Jan. 9, 1953. 28p.

Uranium, coolant, and graphite temperatures have been calculated for PIPPA assuming an instantaneous rise in heat production. The times taken for these component temperatures to reach 95% of their new equilibrium values have been compared with the results of similar calculations on the Harwell Pile. It is found that temperature changes will be much more rapid in PIPPA, the U taking 18 mins compared with 54 mins in the Harwell Pile, the coolant 26 mins compared with 2.4 hrs and the graphite 53 mins compared with 3.2 hrs. Further expressions have been found for the component temperatures in PIPPA following an instantaneous change in reactivity Δk, and allowing for the delayed neutron groups. It is found that to give good estimates of temperature in the first minute of the divergence it is necessary to take into account all the terms in the solution. After that time satisfactory results would be given if only the dominant term was considered, but it must be noted that the method can only give good estimates in the early stages of divergence since the effects of temperature on reactivity are not included. (auth)

566 ORNL-2313

Oak Ridge National Lab., Tenn.

FUEL COSTS IN SPHERICAL SLURRY REACTORS. M. W. Rosenthal, M. Tobias, and T. B. Fowler. Sept. 27, 1957. 44p. Contract W-7405-eng-26. $1.50(OTS).

Fuel costs have been obtained for two-region aqueous homogeneous reactors containing $U^{233}O_3-ThO_2-D_2O$ slurry in both core and blanket regions. For comparison, costs were also computed for one-region slurry reactors and for two-region systems having no Th in the core. The major design variables were core diameter, blanket thickness, Th concentrations in core and blanket, U^{233} concentration in blanket, and poison fraction in core. In the computations, isotope concentrations were established by means of equilibrium isotope equations. The critical fuel concentration was obtained by using a two-group two-region reactor model. Charges for chemical processing by a Thorex plant were estimated with the aid of a simplified cost equation. This study differs from earlier work in the use of a 4% inventory charge and on η for U^{233} equal to 2.25 (rather than 12% and 2.32), as well as in the presence of slurry in the core. Over a wide range, fuel costs were found to be largely insensitive to variations in the design and operating conditions. There appears to be no decisive difference in fuel costs between solution-core and slurry-core systems; breeding gain, however, is improved by the use of slurry in the core. For two-region systems, fuel costs are as low as 1.2 mills/kwhr; for one-region systems they are at least 0.5 mill/kwhr higher. (auth)

567 ORNL-2379

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1957. Oct. 10, 1957. 193p. Contract W-7405-eng-26. $5.00 (OTS).

Homogeneous Reactor Test. Repairs and modification to the HRT system were made throughout the quarter. Effects of letdown rate and O_2 injection rate on Xe poison level and excess O_2 concentration are given. Design of the primary refrigeration system was completed. The HRT mockup terminated a 1580 hr run with 0.04m UO_2SO_4 because of a tube failure in the 80-kw heat exchanger. The fuel and blanket recombiners showed that no significant loss of Pt had occurred since installation. Prototype linear differential transformers were received and will be tested for use on the reactor displacement-type liquid-level transmitters. The low heat transfer of the Ta-lined stainless steel dissolver was remedied by adding Hg to the space between the liner and the dissolver shell. Reactor Design and Analysis. Preliminary flowsheets and design data were prepared for HRE-3, a 60 Mw Th breeder reactor. Nuclear characteristics associated with spherical reactors in the size likely for the HRE-3 were evaluated. Engineering Development. Stress-corrosion cracking of the heat exchanger tube-joint test bundle was noted. The rheology of various ThO_2 slurried is described. Alterations in the HRT slurry blanket test system are given. Reactor Materials Research. The second all-Ti loop, 100A loop H, was placed in operation. Data are given on long-term stability runs with 0.04m UO_2SO_4 containing 0.025m H_2SO_4 and 0.005m $CuSO_4$. The effect of several variables on the corrosion of type 347 stainless steel is discussed. Corrosion of cast Zr-base Alloy by oxygenated 0.04m UO_2SO_4–0.02m H_2SO_4–0.005m $CuSO_4$ solution at 300°C is given. Two test runs were made in an attempt to circulate a 650°C-calcined ThO_2 slurry at a concentration of 1000 g of Th per kilogram of water. The corrosion by ThO_2 slurries with silicate additions is described. Development and construction of in-pile loops is described. Results of corrosion data for Zr alloys in in-pile loops are given. Mechanical properties of Zr–Nb alloy and Zircaloy-2 are given. Chemical Engineering Development. The adsorption of fission product Kr by activated charcoal is described. In-pile experiments were carried out to determine the behavior of Pu and Np produced in a U solution under reactor conditions. The effect of calcination temperature

on the viscosities of ThO_2–U slurries is given. Supporting Chemical Research. The densities of heavy-water liquid and saturated vapor at elevated temperatures up to the critical point were determined. The effect of $CuSO_4$ and H_2SO_4 on the homogeneous catalysis of the H_2-O_2 recombination was studied. Analytical Chemistry. Two improved methods were developed for the separation and estimation of the Al content of contaminated slurries of ThO_2. (For preceding period see ORNL-2331.) (W.L.H.)

568 POC/Mem-20

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

EFFECT OF PRESSURE, TEMPERATURE AND POISON ON THE REACTIVITY OF THE HARWELL PILE. F. W. Fenning. Feb. 1, 1949. 3p.

The loss in k during operation of a pile due to rise in temperature and accumulation of neutron absorbing fission products is known to be quite large and an attempt has been made to analyse the measured losses on the Harwell Pile in terms of temperature coefficients and "poisoning" by Xe^{135}. The variation of the latter with time has been computed by the Theoretical Division on the assumption that all the Xe^{135} is produced from the Te^{135} chain of fission products. (auth)

569 POC/Mem-32

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EXPERIMENTAL DETERMINATION OF THERMAL TIME LAGS OF THE HARWELL PILE AND THEIR EFFECT ON PILE SAFETY. R. V. Moore. Aug. 26, 1949. Decl. July 4, 1957. 19p.

Empirical equations are constructed from test data, expressing the rise in uranium, graphite and channel air temperature with time for a suddenly generated nuclear power and comparison is made with equations deduced theoretically. Similar expressions are developed for a pile diverging exponentially with a given period and the effectiveness of ion chamber and thermal trips of the Harwell Pile assessed for a 10 second doubling time. The limit to which the power of a diverging pile may be considered exponential is investigated for a 20 second period and this data also illustrates the stabilizing effect of the uranium temperature coefficient. The effect of thermal time lags on operational temperature and power measurement is included. (auth)

570 RAG-1

Reaktor A. G., Würenlingen, Switzerland.

ABSOLUTE REACTIVITY MEASUREMENT FROM TRANSIENT BEHAVIOUR OF A SUBCRITICAL NUCLEAR REACTOR. P. Schmid. June 20, 1957. 16p.

It is shown that absolute reactivities can be measured with good accuracy from the transient behavior of a subcritical nuclear reactor. The method is characterized by the application of step functions (either in neutron source strength or in reactivity) and by the observation of a time lag of the integrated reactor power. Simple formulae for the least square fit of experimental data are deduced, and some experimental checks at the Swiss swimming pool reactor SAPHIR are briefly summarized. (auth)

571 RAG-2

Reaktor A. G., Würenlingen, Switzerland.

DESCRIPTION OF THE SWISS RESEARCH REACTORS. F. Alder, A. Colomb, A. Fritzsche, P. Schmid, F. Staub, and W. Zünti. Aug. 12, 1957. 47p.

The Swiss research reactors SAPHIR and DIORIT are described, the text being illustrated by a number of rather detailed drawings. SAPHIR is a modification of the Geneva Conference swimming pool reactor, containing 20% enriched U fuel. The new design power level is 1 Mw. Mainly intended for educational and research purposes, this reactor went critical in April 1957. DIORIT is a heavy water moderated, heavy water cooled, natural U research and testing reactor with a nominal design power of 12.5 Mw. It is constructed by Reactor Ltd., Würenlingen, and shall go critical early in 1959. (auth)

572 RCTC/P-92

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

FAST REACTOR FUEL PROCESSING—THE ECONOMIC IMPORTANCE OF COOLING TIME. F. Roberts and K. M. Towers. Feb. 1957. 9p.

The economic implications of shortening fuel cooling time have been studied for a 1000 Mw fast reactor power station using a plutonium alloy fuel in the core. The likely saving on annual interest charges by reducing cooling time from 120 down to 30 days would be equivalent to a reduction in processing plant costs of 50%, if a plutonium cost of 85 per gram is assumed. It is considered that a pyrometallurgical process should be developed, as this represents the most favorable approach to shortening cooling times. (auth)

573 TID-7013

Battelle Memorial Inst., Columbus, Ohio.

U.S. RESEARCH REACTORS. J. W. Chastain, ed. Aug. 1957. 78p. $1.75(OTS).

This book, illustrated with drawings, photographs, diagrams, and charts, describes more than 30 research reactors, now in operation or under construction. The reactors are grouped according to major types. One or two examples of each are described at length as typical. Features of others are illustrated and significant data given for all. Cost information is furnished for most of the research reactors, including analysis of the relation between the initial cost of the reactor itself and total costs incurred to make it useful. Chapters are included on Light Water Moderated Reactors (Pool and Tank types), Heavy Water Moderated Reactors, Graphite Moderated Reactors, Homogeneous Reactors, and Reactors for Safety Research. It also has a brief glossary of reactor terms, and a list of research reactors built, under construction, or planned in the United States, including those intended for foreign locations. (auth)

574 TID-7535

Argonne National Lab., Lemont, Ill.

PAPERS PRESENTED AT THE TECHNICAL BRIEFING SESSION HELD AT ARGONNE NATIONAL LABORATORY, MAY 27-28, 1957. Boiling Water Reactor Program. 164p. $4.25(OTS).

Papers are presented on the EBWR as follows: a general description; the economic aspects; pressure-vessel design rules, installation history and preliminary performance; design and fabrication of the core structure and fuel-handling system; physics experiments; control-rod drive mechanism; power controls; instrumentation of the power plant; plant equipment, leakage and radioactivity; water treatment, decomposition, and decontamination factor; and safety provisions. Other papers on boiling water reactors include program planning for civilian power reactors, experiments with oxide fuels for Borax IV, and preliminary design of the Argonne Boiling Reactor Facility. (M.H.R.)

575 WAPD-TM-71

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CELL CALCULATIONS AND FLUX APPROXIMATIONS FOR SIMPLE SLAB GEOMETRY. G. W. Simon and A. W. Gray. July 1957. 33p. Contract AT-11-1-GEN-14. $6.30(ph OTS); $3.00(mf OTS).

The results obtained by cell theory are compared with those obtained by two-group diffusion theory and the validity of cell theory calculations is examined. Several simple slab geometries of finite thickness (infinite in their other two dimensions) were used in this study. The first geometry was made up of a series of cells in which the individual cell consisted of a thin control slab symmetrically surrounded by uniformly loaded bare slabs. The second, a seed-blanket core, consisted of a highly enriched seed symmetrically surrounded by a blanket region which contained natural U. The seed-blanket core was controlled by a single control slab at its center, and the cell size was chosen to be equal to the entire seed region. For three variations of seed width the fuel constants of the seed were changed to obtain criticality. In all cases studied, criticality results were obtained with the control slabs fully inserted. To obtain the control material worth, the control slabs were replaced by water. As a further investigation into some of the properties of cell theory, flux approximations for the one-dimensional case are discussed. (auth)

576 WAPD-TM-72

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. MUFT-4 — FAST NEUTRON SPECTRUM CODE FOR THE IBM-704. Henry Bohl, Jr., Ely M. Gelbard, and Georgea H. Ryan. July 1957. 34p. Contract AT-11-1-GEN-14. $1.00(OTS).

Modifications to a multigroup Fourier transform calculation code, MUFT-3, are presented. These modifications were designed to improve the treatment of nonhydrogenous moderation, and to take into consideration the effect of resonance self-shielding on the production of fission neutrons. (M.H.R.)

577 IGRL-T/W-34

TEMPERATURE MEASUREMENTS IN AN ALUMINUM-CANNED URANIUM SLUG. G. Franco and A. Pedretti. Translated by T. Rigg from Energia nucleare (Milan) 3, 39-45(1957). 9p.

This paper was abstracted from the original language and appears in NSA Vol. 10 as abstract No. 6993.

578

PHYSICAL AND CHEMICAL CONTROL PROBLEMS IN ATOMIC REACTORS, ESPECIALLY CONDUCTIVITY MEASUREMENT, pH MEASUREMENT, AND GAS ANALYSIS. Stefan Block. Atomkern Energie 2, 18-25(1957) Jan. (In German)

579

THE SELECTION OF A COMMERCIALLY OPERATIVE HEAVY WATER HETEROGENEOUS REACTOR WITH NATURAL URANIUM. H. Engel. Atomkern Energie 2, 45-50(1957) Feb. (In German)

580

THE REACTORS AT MARCOULE. Atomkern Energie 2, 58-62(1957) Feb. (In German)

The characteristics of the G-1 and G-2 plutonium production reactors at Marcoule are given. A picture and a schematic diagram of the G-1 are included. (M.H.R.)

581

REPORT ON THE NUCLEAR ENERGY PLANT OF HARWELL AND CALDER HALL. III. ZEPHYR. IV. DIMPLE. V. ZEUS. VI. DIDO. VII. PLUTO. VIII. LIDO. W. Knuz. Atomkern Energie 2, 93-7(1957) Mar. (In German)

582

THE TRANSPORT THEORY TREATMENT OF A SMALL CRITICAL ASSEMBLY. Klaus O. Thielheim. Atomkern Energie 2, 121-5(1957) Apr. (In German)

583

NEUTRON DIFFUSION THROUGH THIN LAYERS. P. St. Pütter. Atomkern Energie 2, 125-9(1957) Apr. (In German)

Discussions are included on the influence of vacuum, absorbing layers, and weak absorbing and weak scattering layers on neutron distribution. The question of the validity of the diffusion theory equations is discussed. (M.H.R.)

584

THE PURITY OF REACTOR MATERIALS. Heimo Hardung-Hardung. Atomkern Energie 2, 135-6(1957) Apr. (In German)

585

DEVICE FOR IRRADIATION AT LOW TEMPERATURES IN AN ATOMIC PILE. Pierre Lacusson. Compt. rend. 245, 678-80(1957) Aug. 5. (In French)

A description of an irradiation arrangement, cooled by liquid N_2, is given. It is to be installed in a small channel in the E. L. 2 reactor at Saclay, France. (tr-auth)

586

CHEMISTRY AND NUCLEAR CHEMISTRY IN REACTOR TECHNOLOGY. Peter Faber. Die Atomwirtschaft 2, 282-4(1957) Sept. (In German)

587

HOMOGENEOUS REACTORS. F. Dalla Volta and M. Schiavon. Energia nucleare (Milan) 4, 283-92(1957) Aug. (In Italian)

The chemical and technological probelms of homogeneous aqueous reactors are dealt with. Using special constructive solutions, these reactors give the opportunity of obtaining positive breeding gains or, generally, very high conversion ratios. The main technical difficulties to be overcome in the reactor design and in the design of the whole power plant are pointed out. (auth)

588

ATOMIC FUELS. Frank H. Spedding (Iowa State Coll., Ames). Metal Progr. 72, No. 4, 105-11(1957) Oct.

A general survey is given of the various aspects of nuclear fuel technology. Factors discussed include cost of fuel cycle variables in reactor design, uranium and thorium availability, nuclear physics considerations, enriched fuels, radiation and corrosion effects, and possible future reactor considerations. (J.E.D.)

589

RWE 1. THE A.M.F. MITCHELL REACTOR FOR FRANKFURT. Nuclear Eng. 2, 378-80(1957) Sept.

The engineering design of the enriched U closed cycle boiling light water system employing natural circulation is given. The maximum output is 58 Mw (heat) with a guaranteed net output of 16.2 Mw. Other pertinent facts and a drawing of the reactor and turbine house are included. (T.R.H.)

590

REPORT FROM MARCOULE. Nuclear Power 2, 356-61 (1957) Sept.

A description of the almost-completed G1 reactor and the under-construction G2 reactor at Marcoule, France is given. At the same site a Pu extraction plant and a graphite machining shop are under construction and in operation respectively. (T.R.H.)

591

THE RWE-ATOMKRAFTWERK KAHL. A CLOSED-CYCLE BOILING-WATER REACTOR. H. J. Coles (Mitchell Engineering, Ltd.). Nuclear Power 2, 369-73(1957) Sept.

The closed-cycle boiling-water reactor under construction near Frankfurt, Germany, is described. (T.R.H.)

592

POWER REACTORS. 3. TECHNICAL PROBLEMS. Walter H. Zinn (General Nuclear Engineering Corp.). Nucleonics 15, No. 9, 100-3(1957) Sept.

An analysis is presented of the present state of reactor engineering, and predictions are made as to future developments. (C.H.)

593

POWER REACTORS. 5. EQUIPMENT MARKET. Alfred Iddles (Atomic Industrial Forum). Nucleonics 15, No. 9, 108-10(1957) Sept.

The next decade promises to be one of steady, solid, and substantial growth for nuclear power equipment manufacturers. However, the time required to train necessary personnel, the time needed to construct prototype plants, and the projected costs of these first plants will tend to act as a brake upon the rapid growth of this market. (C.H.)

594

REACTOR PHYSICS. Bernard I. Spinrad (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 9, 131-3 (1957) Sept.

Reactor physics is defined as the study of the interaction of neutrons with bulk matter. It is particularly concerned with such interactions in systems containing fissionable materials. It encompasses the study of criticality of such systems and of the changes in criticality arising from mechanical, thermal and radiation-induced changes in their properties. The development of reactor physics as a science is reviewed and future developments are predicted. (C.H.)

595

REACTOR MATERIALS. D. O. Leeser (Atomic Power Development Associates). Nucleonics 15, No. 9, 137-9 (1957) Sept.

Technological advances made in the development of reactor materials during the past ten years are reviewed. It is predicted that during the next ten years designers will specify more stringent conditions requiring better thermal, radiation, and corrosion stability. Problems and approaches to their solution are discussed. (C.H.)

596

REACTOR FUELS. A. R. Kaufmann (Nuclear Metals, Inc.). Nucleonics 15, No. 9, 142-6(1957) Sept.

Characteristics desirable in nuclear fuels are reviewed. The advantages and disadvantages of solid metals, solid alloys, solid compounds, aqueous solutions, fused salts, and liquid metals are discussed. It is predicted that solid fuels will be widely used for at least ten years. Most of these will consist of U-rich alloys, but massive oxide will also be used in the immediate future. Fluid fuels and slurries will become of increasing importance as the necessity for breeding becomes established. (C.H.)

597

PAR HOMOGENEOUS UNIT GAINS; CORROSION SEEMS LICKED. John E. Kenton (Nucleonics, New York). Nucleonics 15, No. 9, 166-8, 170, 172, 174, 176, 178, 180-2, 184(1957) Sept.

598

CALCULATING SPATIAL DISTRIBUTION OF REACTIVITY COEFFICIENTS. Henry E. Stone (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 15, No. 9, 185-8(1957) Sept.

599

METALLO-ORGANIC POLYMERS. POSSIBLE FUEL MATERIALS. A. J. Restaino (Martin Co., Baltimore, Md.). Nucleonics 15, No. 9, 189-91(1957) Sept.

The development and properties of polymers of mono- and dicarboxylic acids with uranium chemically bound, for use as nuclear-reactor moderator-fuel materials is discussed. (C.H.)

Nuclear Transformation

600 AEC-tr-3030

POLARIZED PARTICLE REACTIONS. M. I. Shirokov. Translated from Zhur. Eksptl', i Teoret. Fiz., 32, 1022-35 (1957). 27p.

Statistical tensors of particles which are produced in reactions of the $a + b \rightarrow c + d$ or $a \rightarrow c + d$ type in the most general case when the incident beam and the target particles are in certain spin states, have been obtained. The work is based on using diagonality of the S-matrix of such reactions with respect to the total energy, total angular momentum and its projection and on applying consistently Dirac's transformation theory. New rules of selection completing the Simon and Welton general rules of selection are derived. The first may be considered as generalization of the rule which reads: polarization vector of particles which are produced in a reaction is perpendicular to the reaction plane if the incident beam and the target are unpolarized. The second reads that statistical tensors of a particle which is produced in a reaction determined with respect to its momentum direction are either purely real or purely imaginary if the incident beam and the target are unpolarized. As a specific case, the decay of an unstable particle into particles with spins $\frac{1}{2}$ or 0 has been considered and it has been demonstrated that polarization and angular distribution of these particles depend only upon the spin and the spin state of the decaying particles. (auth)

601

PHOTODISINTEGRATION OF OXYGEN. Sven A. E. Johansson and Bengt Forkman (Univ. of Lund, Sweden). Arkiv Fysik 12, 359-80(1957).

The (γ,p) and (γ,α) reactions in O^{16} have been studied. Oxygen gas was irradiated in the bremsstrahlung beam of a 35 Mev synchrotron. The photoprotons were recorded by nuclear emulsions. Three different maximum bremsstrahlung energies were used: 20.5, 23, and 26 Mev. The low energy irradiation gives a proton spectrum containing well resolved peaks. They are attributed to transitions from resonances in O^{16} to the ground state of N^{15}. There is a very good agreement with the breaks found in the activation curve of the (γ,n) reaction. The information about the resonances in the low energy region is then used to analyze the proton spectrum at the medium energy. Finally, the proton spectrum at the highest irradiation energy is analyzed by means of the information from the other two irradiations. In this way it is possible to resolve the proton spectra in transitions from various resonances or groups of resonances in O^{16} to the ground state and the excited states of N^{15}. The angular distributions of the strongest proton groups have been studied. The information about the photodisintegration of O^{16} obtained in the present work is compared with the predictions of the various models proposed to explain the photodisintegration. Below the threshold of the (γ,p) reaction the photodisintegration of O^{16} was studied by investigating the (γ,α) reaction. Nuclear emulsions were soaked in water in order to increase the oxygen content and then irradiated directly in the synchrotron beam. The α tracks from the photodisintegration of oxygen were identified by the short, heavily ionized track of the recoiling daughter nucleus. The α-particle spectrum shows two groups corresponding to levels in O^{16} at 11.3 and 12.5 Mev. This result is compared with the theoretical calculations based on the α-particle model for O^{16}. The agreement with the theory is very good. (auth)

602

MECHANISMS OF THE (n,2n) REACTION IN Be^9 AND DIFFERENTIAL CROSS SECTION FOR $\varphi = 90°$ AT A NEU-

TRON ENERGY OF 3.7 Mev. P. Huber and R. Wagner. Helv. Phys. Acta 30, 257-60(1957). (In German)

603

THE (γ,np) PROCESS IN Mo^{92} AND Zn^{66}. A. El Sioufi, P. Erdös, and P. Stoll. Helv. Phys. Acta 30, 264-5(1957). (In German)

604

THE (γ,α) PROCESS IN THALLIUM. A. El Sioufi, P. Erdös, and P. Stoll. Helv. Phys. Acta 30, 266(1957). (In German)

605

ANGULAR DISTRIBUTIONS OF THE $Si^{28}(d,p)Si^{29}$ REACTION. Shigeo Takemoto, Tsunekichi Dazai, and Shinji Suganomata (Tohoku Univ., Sendai, Japan). J. Phys. Soc. Japan 12, 1057-60(1957) Oct.

The angular distributions of five proton groups from the $Si^{28}(d,p)Si^{29}$ reaction have been measured in the energy range 0.77- to 1.30-Mev. In this energy region a complicated compound nucleus effect was observed. (auth)

606

PHOTODISINTEGRATION OF THE ALPHA PARTICLE. B. H. Bransden and A. C. Douglas (Univ. of Glasgow) and H. H. Robertson (CERN, Geneva). Phil. Mag. (8) 2, 1211-18(1957) Oct.

The cross section for the two particle, $He^4(\gamma,p)H^3$, photodisintegration of the alpha particle is calculated, taking into account the interaction between the proton and triton in the final state. It is shown that this is insufficient to remove the discrepancy between the experimental cross section, and cross sections calculated with wave functions that are consistent with the binding energy of the alpha particle, even when the tensor force is included in the two body interaction. (auth)

607

PHOTODISINTEGRATION OF THE LIGHTEST NUCLEI. L. L. Foldy (Case Inst. of Tech., Cleveland, Ohio). Phys. Rev. 107, 1303-5(1957) Sept. 1.

It is shown that for nuclei in which the ground state wave function is symmetric in the space coordinates of all the nucleons, such as H^2, H^3, He^3, He^4, the integrated bremsstrahlung-weighted cross section for electric dipole absorption is simply related to the mean-square radius of the nucleus, independent of the existence of correlations between the motions of the nucleons. This relationship was first derived by Levinger and Bethe on the assumption of absence of correlation, and was found to be at variance with known experimental results in heavy nuclei. Experimentally, the relationship is well verified by data on H^2 and He^4. The relationship of the integrated bremsstrahlung-weighted cross section to certain nuclear parameters in the case of Li^6 is briefly discussed. (auth)

608

SPALLATION-FISSION COMPETITION IN HEAVIEST ELEMENTS: TRITON PRODUCTION. William H. Wade, Jose Gonzalez-Vidal, Richard A. Glass, and Glenn T. Seaborg (Univ. of California, Berkeley). Phys. Rev. 107, 1311-13(1957) Sept. 1.

Stacked foils of Au^{197}, Th^{232}, and U^{238} were bombarded, in a series of experiments, with 48-Mev He ions, 24-Mev deuterons, and 32-Mev protons. Tritium from each foil was collected and then measured by a gas-counting technique. The qualitative results indicate that high-energy tritons are emitted in relatively large abundance from all targets and with each of the bombarding particles. Cross sections for triton production from fissionable U^{238} and Th^{232} and from nonfissionable Au^{197} are comparable. The integrated (α,t) cross sections thus determined for U^{238} and Th^{232} are nearly the same as the integrated cross sections for the "(α,p2n)" reactions as determined by measuring the yield of the product heavy isotopes in radiochemical experiments. All of the facts are consistent with a picture of emission of high-energy tritons (whether due to a stripping, pickup, or other mechanism) in which fissionable intermediate nuclei are formed mainly at levels of excitation below their fission thresholds. (auth)

609

GAMMA RADIATION FROM RESONANCE NEUTRON CAPTURE IN MERCURY. H. H. Landon (Brookhaven National Lab., Upton, N. Y.) and E. R. Rae (Atomic Energy Research Establishment, Harwell, Eng.). Phys. Rev. 107, 1333-6(1957) Sept. 1.

An experiment has been performed to detect individual high-energy gamma rays associated with resonance capture in Hg, using an electron linear accelerator as a pulsed neutron source. The gamma-ray spectrum from the 34-ev resonance in the compound nucleus Hg^{200} has intense components of higher energy than does the spectrum from thermal capture in this isotope. From this it can be inferred that the spin of the 34-ev resonance is most probably 1 with negative parity. (auth)

610

STUDY OF REACTION MECHANISMS INVOLVED IN THE $Ca^{40}(d,p)Ca^{41}$ REACTION. L. L. Lee, Jr. and J. P. Schiffer (Argonne National Lab., Lemont, Ill.). Phys. Rev. 107, 1340-2(1957) Sept. 1.

Excitation functions and angular distributions for the $Ca^{40}(d,p)Ca^{41}$ (ground state) reaction have been measured from 1.50- to 4.15-Mev bombarding energy. Strong resonance effects are observed in the excitation functions, indicating that at least 20% of the reaction proceeds through compound-nucleus formation. Angular distributions were measured at 7.5° intervals between 0 and 157.5° in the laboratory system. Although these show strong fluctuations over resonances, a general forward peaking is apparent throughout the energy region studied. (auth)

611

CROSS SECTIONS FOR THE $S^{32}(n,p)P^{32}$ AND THE $S^{34}(n,\alpha)Si^{31}$ REACTIONS. L. Allen, Jr., W. A. Biggers, R. J. Prestwood, and R. K. Smith (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1363-6(1957) Sept. 1.

The cross section for $S^{32}(n,p)P^{32}$ has been measured for incident neutron energies up to 15 Mev. The data at high energies differ from previously published measurements. The cross section for $S^{34}(n,\alpha)Si^{31}$ also has been measured for incident neutron energies up to 14.1 Mev. (auth)

612

ANGULAR DISTRIBUTION OF PROTONS AND THE $Ca^{40}(d,p)Ca^{41}$ REACTION. C. K. Bockelman and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 1366-71(1957) Sept. 1.

Proton groups emitted from a thin CaO target under 7-Mev deuteron bombardment were studied with a magnetic spectrograph. Their angular distributions were analyzed in terms of stripping theory to determine the orbital angular momenta and relative reduced widths for neutrons captured to form levels in Ca^{41} up to 4.2-Mev excitation. Capture gamma rays measured elsewhere can be fitted to a scheme comprised of levels strongly excited in the (d,p) reaction. Evidence is found for single-particle $f_{7/2}$, $p_{3/2}$, and $p_{1/2}$ states, but the expected $f_{5/2}$ level does not appear. Relative cross sections and reduced widths for (d,p) reactions forming states in Ca^{43} and Ca^{45} are also tabulated. (auth)

613

PRODUCTION OF THE NEW ELEMENT 102. P. R. Fields and A. M. Friedman (Argonne National Lab., Lemont, Ill.); J. Milsted (Atomic Energy Research Establishment, Har-

well, Eng.); and H. Atterling, W. Forsling, L. W. Holm, and B. Aström (Nobel Inst. of Physics, Stockholm, Sweden). Phys. Rev. 107, 1460-2(1957) Sept. 1.

The activity ascribed to element 102 was made by bombarding Cm^{244} with high-energy C^{13} ions in the 225-cm cyclotron. The isotope produced was most likely either that of mass 253 or 251, made by the nuclear reactions: $Cm^{244}(C^{13},4n)102^{253}$ or $Cm^{244}(C^{13},6n)102^{251}$. (M.H.R.)

614

ANNIHILATION OF POSITRONS IN GASES. Milton Heinberg and Lorne A. Page (Univ. of Pittsburgh). Phys. Rev. 107, 1589-1600(1957) Sept. 15.

The angular correlation of the two-photon annihilation of positrons annihilating in gases at high pressures demonstrates the two modes of decay—(1) from a bound state, positronium, and (2) from an unbound state—in all gases tested that have low-lying energy states. The increase in the narrow component in Ar, plus suitable thermalizing gases, due to the application of a dc magnetic field obeys the theoretical increase due to the mixing of the $1\ ^1S$ and $1\ ^3S$ m = 0 states. The increase in positronium formation due to the application of a dc electric field is observed. Preliminary evidence for the existence of n = 2 states of positronium is seen. (auth)

615

ENERGY DEPENDENCE OF REACTIONS AT THRESHOLDS. G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 107, 1612-15(1957) Sept. 15.

As a development of Wigner's work on the subject, the behavior of nuclear reactions at thresholds is discussed by employing the $\mathcal{R}$-matrix formalism with special attention to the effect of a nuclear reaction threshold in a particular channel on the energy dependence in other channels. In addition to the characteristic cusp-like behavior for $L = 0, Z_1Z_2 = 0$ it is found that for this case it is also possible to have another type of plot of cross section versus energy. The second type differs from the first by a relative change of sign of the extra effect on one side of the threshold. (auth)

616

T(d,n)He^4 REACTION. S. J. Bame, Jr. and J. E. Perry, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1616-20(1957) Sept. 15.

The differential cross sections for neutron production in the T(d,n)He^4 reaction have been measured over the deuteron bombarding-energy range 0.25 to 7.0 Mev. Legendre polynomial fits to the data are presented and compared with existing data. The total cross section plotted as a function of deuteron energy has an anomalous behavior which may indicate a broad level in He^5 near 20-Mev excitation energy. (auth)

617

ABSOLUTE INTENSITIES OF RESONANCE NEUTRON CAPTURE GAMMA RAYS FROM Cd, Te, AND Sm. C. A. Fenstermacher, R. G. Bennett, A. E. Walters, C. K. Bockelman, and H. L. Schultz (Yale Univ., New Haven, Conn.). Phys. Rev. 107, 1650-4(1957) Sept. 15.

The absolute intensities of gamma rays having energies between 200 and 650 kev, emitted after resonant neutron capture in Cd^{113}, Te^{123}, Sm^{147}, Sm^{149}, and Sm^{152} have been measured. The instrumentation involved a combination of time-of-flight technique and multichannel pulse-height analysis using a NaI(Tl) scintillation counter. The even-even compound nuclei studied appear to emit intense low-energy gamma rays, while the even-odd nucleus Sm^{153} shows no correspondingly intense low-energy transitions. (auth)

618

THE ELASTIC PHOTOPRODUCTION OF NEUTRAL PIONS FROM HELIUM. E. H. Bellamy, R. W. P. McWhirter, and P. Palit (Univ. of Glasgow). Proc. Phys. Soc. (London) A70, 763-5(1957) Oct.

In order to improve the reliability of measurements of He^4 recoil particles from the reaction $\gamma + He^4 \rightarrow \pi^0 + He^4$, an attempt was made to build a detector which would distinguish He^3 from He^4 particles. Results with this detector are given. (M.H.R.)

619

THE THEORY OF CONVERSION COEFFICIENTS. Gustav Kramer (Univ. of Heidelberg). Z. Physik 147, 628-35(1957). (In German)

Particle Accelerators

620 AERE-GP/R-2000

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A DESIGN FOR A STRUCTURE FOR ACCELERATION OF PROTONS FROM 150 TO 600 MEV. P. D. Dunn and D. J. Thompson. Mar. 29, 1957. 22p.

Following an investigation into methods of coupling described in previous reports, more detailed measurements on certain types are summarized, and a choice of coupling device is made for use in a proton linear accelerator structure consisting of π-mode pill-box resonators. A model resonant at 3,000 Mc/s of a section of such a machine was constructed, and its radio-frequency properties investigated and compared with theory. (auth)

621 AERE-T/R-2209

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ANALYTICAL TREATMENT OF NON-LINEAR EFFECTS IN THE SPIRAL RIDGED CYCLOTRON. M. Bell. Mar. 1957. 36p.

The $2\pi/3$ and $\pi/2$ resonances, which arise in the radial betatron oscillations in the Harwell cyclotron conversion, are examined using P. A. Sturrock's method, and the phase plots obtained compared with those found by direct numerical integration of the differential equation. Good agreement is found in the estimation of the range of stable amplitudes near the $2\pi/3$ resonance; for the other resonance the quantitative agreement is poorer although the qualitative features are shown. (auth)

622 AEC-tr-3073

ACCELERATORS OF IONS AND ELECTRONS. Čestmir Šimáně, Inst. of Nuclear Physics at Prague. Translated from the Czech edition by C. Mayer and A. G. Evans. Printed in Czechoslovakia by ARTIA Prague. [195?]. 191p.

Explanations are given of the principles of action, the most important calculations, and the construction details of accelerators of ions and electrons, linear as well as circular types. A description of auxiliary equipment for accelerators and its operation is included. The importance of practical utilization of accelerators is illustrated. (auth)

623

THE FUNDAMENTAL CHARACTERISTIC OF THE PLANNED 50 TO 60 Bev PROTON ACCELERATOR WITH FIXED FOCUS. V. V. Vladimirskij. Atomkern Energie 2, 62-4(1957) Feb. (In German)

624

NEW POSSIBILITIES IN INCREASING THE EFFICIENCY OF ACCELERATORS OF CHARGED PARTICLES. E. M. Moroz (Lebedev Phys. Inst., Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 115, 78-9(1957) July 1. (In Russian)

Descriptions are offered for new type accelerators with constant, in time, magnetic fields and with stable contiguous particle trajectories. The magnetic system of the accelerators consists of three or more sectors with homogeneous magnetic fields. A scheme is presented of one of the variations of the system with a four-sector magnet having an equal magnetic field strength. The use of the sectioned magnetic systems with the stable contiguous trajectories of the accelerated particles should lead to the further development of microtrons and expansion of their use as synchrotron injectors, as generators of short strong electron pulses, and as generators of microradiowaves as well as generators of γ-ray pulses, effective neutron sources, etc. (R.V.J.)

625

SECOND-HARMONIC ACCELERATION IN THE CYCLOTRON. K. E. A. Effat and J. H. Fremlin (Univ. of Birmingham, Eng.). J. Sci. Instr. 34, 415-17(1957) Oct.

It is shown that steady acceleration is possible in the cyclotron, for ions which take an even number of radio-frequency cycles for one revolution, if the center of revolution is to one side of the dee gap. The acceleration of HD^+ ions, taking two radio-frequency cycles to complete one revolution, has been observed and confirmed by several methods. The contribution of this process to the production and acceleration of multiply charged heavy ions is discussed. (auth)

626

THE ENERGY SPECTRUM OF THE 350 Mev NEUTRON BEAM FROM THE LIVERPOOL SYNCHROCYCLOTRON. A. Ashmore, R. G. Jarvis, D. S. Mather, and S. K. Sen (Univ. of Liverpool). Proc. Phys. Soc. (London) A70, 735-44(1957) Oct.

A knowledge of the energy spectrum of the neutron beam from the 156-inch cyclotron was required for cross section measurements. The spectrum of the recoil protons produced in n–p collisions was measured with a counter telescope containing a Cu absorber of variable thickness. A calibration run was made in the external proton beam to measure the transmission of the absorber as a function of proton energy. It was found that the shape of the spectrum was consistent with the assumption that the neutrons are produced in elastic proton–neutron collisions in the Be target. The shape is then determined by the amplitude of radial oscillations in the cyclotron and the energy lost by the protons in their multiple traversals of the target. (auth)

627

RESONANCE PERTURBATIONS OF SYNCHROTRON OSCILLATIONS IN CHARGE PARTICLE ACCELERATORS. I. S. Danilkin and M. S. Rabinovich (Lebedev Inst. of Physics, Moscow). Zhur. Tekh. Fiz. 27, 1558-70(1957) July. (In Russian)

Resonance perturbations of synchrotron oscillations in synchrocyclotrons or other accelerators of charged particles, occurring from various technical pulsations in their service equipment, are discussed. Effects of resonance harmonic perturbations on the phase motion and on the intensity of the accelerated particles were studied, and comparisons are made between the theory and the experiments made on the 10 Bev synchrocyclotron. The results permitted determination of the tolerance for the resonance components of technical pulsations in the radiofrequency system of the accelerator, the magnet, etc. (R.V.J.)

628

ON THE EFFECTS OF QUANTUM TYPE RADIATION ON THE RADIAL-PHASE OSCILLATIONS IN HIGH ENERGY ELECTRONIC CYCLIC ACCELERATORS. V. N. Didenko (Moscow State Univ.). Zhur. Tekh. Fiz. 27, 1624-7(1957). (In Russian)

The character of radiation-induced radial-phase oscillations in accelerators with weak focusing along their acceleration cycle was studied in relation to various working conditions and the maximum energies possible for such machines. (R.V.J.)

629

STRONG FOCUSING IN LINEAR ELECTRON ACCELERATORS. K. N. Stepanov and A. A. Sharshanov (Physico-Tech. Inst., Khar'kov). Zhur. Tekh. Fiz. 27, 1863-9(1957) Aug. (In Russian)

Studies were made of the radial motion of a strongly relativistic electron in a linear accelerator with alternating-gradient focusing. (R.V.J.)

Radiation Absorption and Scattering

630 NARF-57-39T

Convair, Fort Worth, Tex.

STUDIES IN SHIELDING. PART II. SINGLE SCATTERING AND CAPTURE THEORY IN AIR AND GROUND. R. E. Beissner and D. R. Smith. Sept. 30, 1957. 45p. Project 6(1-9964). Contract AF33(600)-32054. (FZK-9-117).

This report presents the derivation and evaluation of four of the more important equations used by Convair-Fort Worth in the prediction of gamma and neutron dose rates. The relations derived concern air and ground single scattering of neutrons and gamma rays and the radiative capture of thermal neutrons in the air and in the ground. A discussion of the equations and their importance in total dose rate prediction follows the derivations. (auth)

631 PA-TR-2393

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

PENETRATION OF EXPLOSIVES BY HEAVY NUCLEAR PARTICLES. Rufus C. Ling. Apr. 1957. 26p. DA Project 5A04-01-015. (AD-126607).

The possibility of the initiation of detonation by nuclear particles is calculated and discussed. The classical theory of N. Bohr, together with the assumption of additivity of stopping cross sections, is adopted to compute the stopping power of ten different explosives for charged particles. The range and time of flight of the alpha particle and of the fission fragment, (Z = 37, M = 95) are evaluated by numerical analysis. The heating effect produced by the irradiation with nuclear particles is presented and the rate of rise of average temperature in explosive compounds is calculated. These calculations are such that, by use of the ignition temperatures available, the minimum source strength required for detonation may be predicted. (auth)

632 WCRT-TM-57-47

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

DIFFERENTIAL ENERGY SPECTRUM OF DEGRADED GAMMA RAYS USING AN ARBITRARY SOURCE FUNCTION. R. L. Hickmott. Apr. 18, 1957. 11p. Project 7360.

A straightforward method of obtaining the differential energy spectrum of degraded gamma rays from an arbitrary source is justified by means of an example. The differential spectrum due to penetration of γ radiation with a source distribution which approximates a fission spectrum is calculated for 100 cm penetration through water. (M.H.R.)

633

THE EXCITATION AND AUTOIONIZATION OF ELECTRONS ACCOMPANYING K-CAPTURE IN Ge^{71}. Michel

Langevin. Compt. rend. 245, 664-7(1957) Aug. 5. (In French)

A study, using a proportional counter, of the probability of creation of a double layer in the K shell during K capture led to the value $P_2 = (1.33 \pm 0.15) \times 10^{-4}$, the partial probability of autoionization being, $P_{eject} = (0.78 \pm 0.07) \times 10^{-4}$. These two values agree with the theory of Primakoff and Porter. (tr-auth)

634

A STUDY OF THE LIGHT EMITTED IN THE MODERATOR OF A HEAVY WATER MODERATED ATOMIC PILE. Denis Breton and Jean-Loup Delcroix. Compt. rend. 245, 842-5 (1957) Aug. 19. (In French)

During the operation of a reactor using heavy water as a moderator, a bluish light appears in the water. A thorough study of this radiation at the reactor at Fontenay-aux-Roses is reported. (T.R.H.)

635

THE YIELD OF CHARACTERISTIC X-RAYS EXCITED BY β-RAYS. N. Starfelt, J. Cederlund, and K. Lidén (Univ. of Lund, Sweden). Intern. J. Appl. Radiation Isotopes 2, 265-73(1957).

The intensity of the K x-ray peak from β-ray sources of Pr^{143} ($E_{\beta max}$ 0.92 Mev) and $Ce^{144}-Pr^{144}$ ($E_{\beta max}$ 2.98 Mev) sandwiched by tin or lead radiators was measured with a NaI(Tl) scintillation spectrometer. The following maximum yields given as photons per disintegration were found: tin + Pr^{143}, (15–35 kev): 0.028 at a radiator thickness of 68 mg/cm^2, lead + Pr^{143}, (60 to 100 kev): 0.043 at 120 mg/cm^2, and lead + $Ce^{144}-Pr^{144}$ (60 to 100 kev): 0.21 at 270 mg/cm^2. These results together with those of Lidén and Starfelt show that: (1) The ratio between the number of photons in the K x-ray peak and the total number of high energy bremsstrahlung photons for optimum radiator thickness is about 3:1 for low-energy betas + tin, and about 1:1 for high-energy betas + lead. (2) The K x-ray peak intensity increases with $E_{\beta max}$ and with the Z of the radiators; but so does the high-energy bremsstrahlung. The radiator thickness for maximum yield increases with $E_{\beta max}$ at low energies and levels off at a value of about 300 mg/cm^2 for high-Z radiators and $E_{\beta max} > 3$ Mev. Some practical applications are commented upon, particularly the possibilities of Kr^{85}. (auth)

636

GAMMA-RAY ABSORPTION COEFFICIENTS FOR Co^{60}. B. Durga Nagesvara Rao and Swami Jnanananda. J. Sci. Ind. Research (India) 16B, 325-7(1957) Aug.

Absorption coefficients of γ rays of energies 1.1715 and 1.3316 Mev from a 17.1 Mc source, Co^{60}, have been measured in copper, zinc, tin, lead, and mercury absorbers. Based on the geometry of Davisson and Evans, the apparatus was constructed with fine adjustments for accurate collimation. The absorption coefficient values for copper, zinc, and tin show agreement with theoretical values within 0.6 to 1.9%. The values for lead and mercury are 2.7 and 4.4%, respectively, less than theoretical values, confirming the deviations previously observed by workers with heavy elements. No probable experimental reason for deviations as large as these could be found. A part of the deviations has, therefore, been ascribed to an insufficiency in theoretical calculation of photoelectric cross-section. (auth)

637

ELASTIC SCATTERING OF ALPHA PARTICLES. D. D. Kerlee, J. S. Blair, and G. W. Farwell (Univ. of Washington, Seattle). Phys. Rev. 107, 1343-62(1957) Sept. 1.

An extensive study of elastic scattering of medium-energy alpha particles at fixed angles has been made for 28 nuclides ranging from Ni to Pu. The sharp-cutoff model is used to evaluate interaction radii, $R_{A\alpha}$, and a simple graphical method has been developed for these evaluations. A least squares fit to the experimental data of the form $R_{A\alpha} = r_0 A^{1/3} + b$ gives $r_0 = (1.414 \pm 0.042) \times 10^{-13}$ cm, b = $(2.19 \pm 0.20) \times 10^{-13}$ cm. The internal consistency of the data is much higher than the stated over-all errors (standard deviations) indicate; the average departure from the least squares curve is 0.75%. The dependence of interaction radius upon scattering angle is slight over the range of angles studied. Significant differences in interaction radius are seen between Pb and Bi and between U^{235} and U^{238}, among others. Small changes in either neutron or proton configuration influence the detailed structure of the curves of cross section versus energy, especially in the region of a closed neutron or proton shell. The angular and energy dependence of the structure in cross section curves is qualitatively discussed in terms of the sharp-cutoff model. A modification of this theory is used to estimate the cross section for an ellipsoidally distorted nucleus. (auth)

638

PROTON-NUCLEUS SCATTERING AT 17 Mev. A. E. Glassgold and P. J. Kellogg (Univ. of Minnesota, Minneapolis). Phys. Rev. 107, 1372-80(1957) Sept. 1.

Previous studies of proton-nucleus scattering have been extended to 17 Mev. As at 10 Mev, it is difficult to obtain unique sets of parameters because of the similar effects of the real part of the potential V and the interaction radius R, on the one hand, and the imaginary part of the potential W and the diffuseness parameter a, on the other. If the best half-way radius for each element is expressed as $R = r_0 A^{1/3} \times 10^{-13}$ cm, r_0 decreases from $r_0 = 1.29$ for light and medium elements to $r_0 = 1.22$ for heavy elements. Values for the diffuseness parameter near $a = 0.5 \times 10^{-13}$ cm are used. Normalized to $r_0 = 1.30$ the average value of the optical model potential at this energy is $-(50 + i8)$ Mev. Values of the reaction cross section are given. An analysis of proton-carbon scattering from 14 to 20 Mev is presented. It is also shown that proton-nucleus scattering at this energy is insensitive to the precise details of the potential in the central and surface regions. In addition the scattering is independent of the shape of the nuclear charge density for energies up to 100 Mev. (auth)

639

SCATTERING OF LONGITUDINALLY POLARIZED FERMIONS. Adam M. Bincer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 1434-8(1957) Sept. 1.

Cross sections for scattering of longitudinally polarized Dirac particles are calculated. The results are presented in terms of the ratio of cross sections ϕ_p/ϕ_a. (The cross section is denoted by ϕ_p when the spins of the particles before scattering are parallel, by ϕ_a when antiparallel.) In the case of scattering of indistinguishable particles ϕ_p/ϕ_a is different from unity at all energies and scattering angles and can be as small as zero. For particle-antiparticle scattering ϕ_p/ϕ_a is close to unity at nonrelativistic energies, but at relativistic energies approaches the value of the corresponding ratio for indistinguishable-particle scattering. Thus, in both these cases, the scattering process provides a method for measuring longitudinal polarization. Thirdly, ϕ_p/ϕ_a is calculated for two particles of different masses m and μ. It is shown that also in this case, in principle, ϕ_p/ϕ_a could be used for polarization measurements. (auth)

640

DOUBLE SCATTERING OF β PARTICLES. L. J. Tassie (Australian National Univ., Canberra). Phys. Rev. 107, 1452-3(1957) Sept. 1.

Values of asymmetry factors, E and S, for scattering electrons by the Coulomb field of Hg obtained by using

Shermans' tables of F and G, and the values for the screened atomic field of Au obtained from the calculation of Mohr and Tassie are given. (M.H.R.)

641

POLARIZED PROTONS FROM THE ELASTIC SCATTERING OF α-PARTICLES BY HYDROGEN. L. Rosen and J. E Brolley, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 107, 1454-5(1957) Sept. 1.

The prediction that at certain angles the elastically scattered protons will be highly polarized for incident energies up to at least 10 Mev was checked in detail by examining the dependence of polarization on scattering angle for 10-Mev protons on He^4. A method was devised for obtaining a highly-polarized and well-collimated beam of 10-Mev protons of sufficient intensity for use in elastic and inelastic scattering experiments. (M.H.R.)

642

SCATTERING OF LONGITUDINALLY POLARIZED FERMIONS WITH ANOMALOUS MAGNETIC MOMENTS. Adam M. Bincer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 107, 1467-8(1957) Sept. 1.

A generalization of previous work, in which the fermions obeyed Dirac's equation, is given. The expression for the cross section is modified to describe neutron-electron, neutron-μ meson, proton-electron, and proton-μ meson scattering. (M.H.R.)

643

POLARIZATION OF RECOIL PROTONS IN PION-PROTON SCATTERING. Hong-Yee Chiu (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 1468-9(1957) Sept. 1.

It is indicated that the ambiguity in Fermi-type phase shift solutions found at various energies above the $T = 3/2$ state resonance can be resolved by a feasible measurement of the recoil-proton polarization. (M.H.R.)

644

STOPPING POWER OF A MEDIUM FOR HEAVY, CHARGED PARTICLES. Michal Gryziński (Warsaw Univ., Poland). Phys. Rev. 107, 1471-5(1957) Sept 15.

It is shown that the orbital motion of electrons in the molecules of a medium is important for the stopping power of slow charged particles. This is due to the strong dependence of the momentum transfer in a Coulomb field on the relative velocity. Equations for determining the absolute stopping power of an arbitrary medium are derived on the basis of classical mechanics for the entire nonrelativistic energy range. For the high-energy range this equation corresponds to Bethe's formula, and for low energies, to the Fermi-Teller formula. It is concluded, from this equation and from the experimental data, that electron capture is not important in the slowing down of protons. It starts being important for α particles and is decisive for particles of higher charge. The stopping power of H, H_2, and A for protons and of H_2 for α particles is calculated. Good agreement with the experimental data is obtained. (auth)

645

PENETRATION OF ELECTRON BEAMS INTO WATER BELOW THE CRITICAL ENERGY. I. Adawi (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 107, 1476-82(1957) Sept. 15.

The moments technique has been applied to the calculation of the spatial distribution of the energy dissipation in water by electron beams of energies 10 to 25 Mev. A continuous energy loss is assumed and the energy-range relationships are obtained taking into account the ionization and radiation losses. These relationships are introduced in the proper Boltzmann transport equation to approximate the scattering term by a simple function of residual range. The stopping power is approximated by a sum of powers of residual range. This leads to expressing the spatial moments of the energy dissipation as a combination of triple moments of the electron distribution function. These triple moments are the angular, spatial, and residual range moments, which are connected by a recursion system. The first three moments are calculated together with the boundary condition and the asymptotic trend. With this information, the distribution is constructed by using a simple analytical function. The agreement with experimental results is satisfactory. (auth)

646

RANGE STRAGGLING OF HIGH-ENERGY ELECTRONS IN CARBON. J. E. Leiss, S. Penner, and C. S. Robinson (Univ. of Illinois, Champaign). Phys. Rev. 107, 1544-8 (1957) Sept. 15.

Approximate range straggling curves for the slowing down of high-energy electrons in carbon have been calculated by a Monte Carlo technique using the University of Illinois digital computer. The effects of ionization straggling, radiation, and multiple scattering have been included. Calculations were made for incident electron energies from 5 to 55 Mev. (auth)

647

INELASTIC SCATTERING OF 20-kev ELECTRONS IN METAL VAPORS. Lewis B. Leder (National Bureau of Standards, Washington). Phys. Rev. 107, 1569-78(1957) Sept. 15.

The low-energy losses of 20-kev electrons passing through the vapors of Zn, Cd, Hg, Na, K, Mg, Ca, Sb, Pb, and KCl, have been measured by using an electrostatic analyzer previously used for measuring electron energy losses in thin metal films. The atomic transitions corresponding to the measured energy losses are in many cases fairly easily established. However, there remain some which are questionable due to the fact that there is more than one feasible transition with energy differences of the order of the given energy loss. It is established that the principal interaction results in the excitation from the ground state of the neutral atom to the first excited level—the resonance excitation. It is also found that dipole excitations predominate. (auth)

648

ELASTIC SCATTERING OF 7.5-Mev PROTONS. W. F. Waldorf and N. S. Wall (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 107, 1602-8(1957) Sept. 15.

The angular distributions of 7.5-Mev protons elastically scattered from a series of elements with atomic numbers $Z = 13$ to $Z = 49$ were measured. The measurements were made, and the results are presented in terms of the ratio of the differential cross section from a particular nucleus to that of the scattering from a point charge nucleus of the same total charge. The data are interpreted in terms of the scattering from a complex-potential well with the slight variations in nearby elements interpreted as arising from a compound-elastic contribution to the over-all elastic scattering. (auth)

649

SPIN REVERSAL IN SCATTERING PROCESSES. Andrew Lenard (Columbia Univ., New York). Phys. Rev. 107, 1712-13(1957) Sept. 15.

The effect on the scattering matrix element of reversing the spins of all particles is discussed. An exact relation is shown to be the consequence of invariance under combined space and time inversion and the unitarity of the S matrix. In lowest order perturbation theory this gives a symmetry property of the matrix element. The implication for particles in arbitrary states of polarization is pointed out. (auth)

650

MULTIPLE SCATTERING MEASUREMENTS ON HIGH ENERGY PROTONS WITH LONG CELL LENGTHS. S. Biswas, N. Durga Prasad, and S. Mitra (Tata Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. 46, 167-81(1957) Aug.

Scattering measurements on individual tracks and relative scattering measurements on pairs of tracks have been made in two stacks exposed to 6.2 and 5.7 Bev protons respectively from the Berkeley Bevatron. Spurious scattering was determined in these two stacks for cell lengths ranging from 1 mm. to 8 mm. In one stack the magnitude of spurious scattering was very low while in the other it was fairly high. Our results indicate that: Spurious scattering varies with cell length t, as t_x, where x is about 0.8 for t = 1 mm. to 3 mm. and about 0.5 for t = 3 mm. to 8 mm. The spurious scattering is lowest near the glass surface of the emulsion and increases towards the air surface. The small-scale dislocations which give rise to spurious scattering extend in the plane of the emulsion at least over distances of 200 μ, but vary rapidly in size and direction with depth. Therefore, reliable relative scattering measurements require that the separation between the tracks in the depth of emulsion should be as small as possible ($\leq$50 μ) whereas the separation in the plane of the emulsion may be as large as 200 μ. The scattering constant for cell lengths of 1 mm. to 8 mm. has been determined. Our values are about 10% higher than the theoretical values, on the assumption that the proton energy in the Bevatron was known accurately at the time the plates were exposed. (auth)

651

A PHASE-SHIFT ANALYSIS OF NUCLEON-NUCLEON SCATTERING AT 95 Mev. R. J. N. Phillips (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Proc. Phys. Soc. (London) A70, 721-8(1957) Oct.

A phase-shift analysis of n–p and p–p cross sections and polarizations at 95 Mev is made in terms of S, P and D partial waves. Three distinct small regions in the phase-shift space are found to be able to account for the data, at least approximately. Although the results indicate that F-wave effects are significant at this energy, test calculations suggest that they may be considered as a small perturbation. (auth)

652

THE BREIT EQUATION FOR ELECTRON-PROTON SCATTERING. H. Marschall. Z. Physik 147, 247-52(1957). (In German)

Radiation Effects

653 AECU-3566

Knolls Atomic Power Lab., Schenectady, N. Y.

EXTENSION OF OPERATING LIFE OF KAPL-30 THIMBLE. D. M. Lewis. July 22, 1957. 37p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Due to extended low-temperature operation of the KAPL-30 carbon steel thimble in the Materials Testing Reactor, a radiation damage evaluation was undertaken. Radiation damage in carbon steel may not be annealed under low-temperature operating conditions. The data used in the evaluation are presented, and an extension of thimble life to 16 reactor cycles is recommended, subject to review if further low-temperature operation occurs. (D.E.B.)

654 AERE-M/R-2305

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STRENGTH OF SILICA GLASS AFTER PILE IRRADIATION AT +100°C AND –196°C. M. W. Thompson. June 1957. 4p.

The strength of silica glass rods, measured at –196°C, was observed after irradiation in BEPO at 100 and at –196°C. No changes greater than 10% were observed after 2.4×10^{19} nvt at +100°C or after 1.6×10^{18} nvt at –196°C. (auth)

655 KAPL-1784

Knolls Atomic Power Lab., Schenectady, N. Y.

THE FAST OXIDE BREEDER — FUEL IRRADIATION EXPERIMENTS. W. M. Cashin. Aug. 26, 1957. 22p. Contract W-31-109-Eng-52. $0.50(OTS).

A fuel concept applicable to a fast breeder reactor is described. Mixed PuO_2–UO_2 fuel elements were irradiated. Central void formation was observed, but no settling of the fuel occurred. Details of the irradiation experiments are given. (auth)

656 NP-6442

New York Univ., New York.

RESEARCH OF FLUORESCENCE AND CONDUCTIVITY PHENOMENA. Quarterly Progress Report No. 1 for February, March, April [1957]. Hartmut Kallmann. July 1957. 78p. Contract DA-36-039-sc-73145.

Progress is reported in studies on energy transfer in liquid solutions under light and high energy excitation; energy transfer in plastics; the effect of externally applied dc and ac fields on the ac photoconductivity of ZnS and ZnCdS powder phosphors; and the effect of externally applied fields on the trap occupation distribution in ZnS and ZnCdS phosphors. (C.H.)

657 NP-6449

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 3 [ON RADIATION EFFECTS DATA]. Sept. 15, 1957. 40p. Project No. 2133. Contract AF33(616)-5171.

658 WADC-TN-57-207

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

STANDARD INSTRUMENTATION TECHNIQUES FOR NUCLEAR ENVIRONMENTAL TESTING. [Period Covered] July 1956 to May 1957. Walter R. Burrus. May 17, 1957. 29p. Project title: NUCLEAR INSTRUMENTATION.

Recommendations from the ANP Advisory Committee for Nuclear Measurements are presented and discussed. A minimum number of measurements were selected which can provide a consistent basis for comparison of experiments and correlation of data. A measurement of absorbed dose in C is recommended as the minimum measurement of the gamma radiation field. In addition, determination of the activation of U^{238}, Pu^{239} (B shielded), and S is recommended as the minimum measurement for neutron radiation. Consistent units and symbols for reporting these measurements are recommended. (auth)

659

MAGNETIC ANALYSIS OF X-RAY PRODUCED PHOTO AND AUGER ELECTRONS. Evelyn Sokolowski, Carl Nordling, and Kai Siegbahn (Univ. of Uppsala). Arkiv Fysik 12, 301-18(1957).

A precision method has been developed to determine atomic binding energies by means of magnetic analysis of photo electrons expelled from thin evaporated layers by x radiation. The accuracy achieved in the present investigation is of the order of one electron volt, the limits being set essentially by the inherent widths of the atomic levels. The element Cu has been studied and the K and L_1 binding energies found are 8985.5 ev and 1100 ev respectively. Further, the KLL and KLM Auger spectra have been in-

vestigated. Seven well-resolved lines have been obtained in the KLL group. Earlier investigations have given only three KLL Auger lines in Cu due to insufficient resolution, whereas theory indicates the possibility of ten lines in this group. Peaks due to electrons which have suffered discrete energy losses are observed on the low energy flanks of the photo lines. (auth)

660

THE EFFECTS, AT LOW TEMPERATURES, OF FAST NEUTRONS ON METALS WITH BODY-CENTERED CUBIC STRUCTURE. Pierre Laucasson. Compt. rend. 245, 796-9(1957) Aug. 12. (In French)

Samples of Nb, Ta, and W were irradiated at low temperatures in an apparatus at Saclay. The electrical resistance of the sample was measured as a function of integral neutron flux. Some isochronic anneals were applied and the corresponding variation in resistance measured. (tr-auth)

661

EFFECTS OF NEUTRON BOMBARDMENT OF MARTENSITE TRANSFORMATION. A. I. Zakharov and O. P. Maksimova (Central Research Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 114, 1195-8(1957) June 21. (In Russian)

Attempts were made to adapt neutron bombardment in investigation of martensite transformations. Preliminary studies were made of plastic deformation effects on the martensite transformation of steel and alloys. Specimens of manganese steel (0.48% C, 7.7% Mn, T_m = 10°C) and (1.40% C, 4.0% Mn, T_m = 94°C), nickel steel (0.50% C, 21.0% Ni, T_m = 28°C), and, Fe–Ni–Mn alloys (0.025% C, 22.7% Ni, 2.88% Mn, T_m = −39°C) were investigated. Bombardments of specimens, annealed in vacuum at 111°C, were carried out in the active zone of a heavy water reactor near U cores. One group of samples was bombarded for 100 hr, the other for 200 hr, with a neutron current of the order of 10^{17} n/cm^2. The austenite stability was evaluated on magnetometric curves of deep heating and cooling. The bombardment increased intensity of martensite transformation in all specimens of steel; however, in the specimens of Fe–Ni–Mn alloys it had a stabilizing effect on the γ phase, lowered the martensite point, and reduced the intensity of transformation. However, it would be erroneous to conclude that the bombardment activation pertains only to steels, rather that the bombardment process causes simultaneous structural changes and depends on the properties of austenites. (R.V.J.)

662

EFFECT OF RADIATION ON SEMICONDUCTORS. J. C. Pigg and C. C. Robinson (Oak Ridge National Lab., Tenn.). Elec Mfg. 116-24(1957) Apr.

When high-energy particle bombardment is part of the environment, circuit designs employing semiconductors must include consideration of the effects of crystal lattice disorder. Changes in characteristics of typical semiconductor components when subjected to various radiation levels are described. (auth)

663

EXPANSIONS IN REACTOR IRRADIATED GERMANIUM AND SILICON. M. C. Wittels (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 28, 921(1957) Aug.

664

EFFECT OF IRRADIATION OF DYNAMIC MECHANICAL PROPERTIES OF 6-6 NYLON. C. W. Deeley, A. E. Woodward, and J. A. Sauer (Pennsylvania State Univ., University Park). J. Appl. Phys. 28, 1124-30(1957) Oct.

Measurements of elastic modulus and mechanical loss at audio-frequencies have been obtained on irradiated and nonirradiated specimens of polyhexamethylene adipamide over a broad temperature range extending from 80 to 600°K. The irradiations were carried out at the Brookhaven and Penn State Reactors. The internal friction spectrum of unirradiated nylon 6-6 contains at least four peaks corresponding to different mechanisms being invoked as the temperature is raised. With irradiation doses from 0.3 × 10^{18} nvt to 5.5 × 10^{18} nvt, significant changes in the dispersion regions occur. At temperatures above the main softening region, an increase in modulus with temperature is found. This is evidence of rubber-like behavior and is accounted for by the introduction of cross-links resulting from ionization and free radical formation produced by the irradiation. At high irradiation doses the percent cross-linking appears to become independent of dose. The various effects found are discussed in terms of molecular forces and mobility of chain segments. (auth)

665

EFFECT OF IRRADIATION ON THE HOLE LIFETIME OF N-TYPE GERMANIUM. O. L. Curtis, Jr., J. W. Cleland, J. H. Crawford, Jr., and J. C. Pigg (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 28, 1161-5(1957) Oct.

The minority carrier lifetime of Ge is very sensitive to certain types of irradiation. The results of irradiating large single crystal samples of n-type Ge with fast neutrons and Co^{60} gamma rays are presented and discussed. Lifetime was determined from a transient measurement of the decay of holes following an injection pulse. The effect of initial carrier concentration has been considered. According to the James-Lark-Horovitz model, four energy levels are introduced by irradiation into the forbidden band of Ge, one above and three below the center of the band. Using the upper level, a one level recombination model serves to explain the experimental results approximately. The determination of the recombination level agrees well with the position of the first ionization level of the interstitial produced by irradiation at about 0.2 ev below the conduction band. On this basis, the effective cross section for hole capture by these recombination centers is found to be about 4 × 10^{-15} cm^2 and 5 × 10^{-16} cm^2 for neutron and gamma-irradiated Ge, respectively. A lower level may also be responsible for the recombination process. (auth)

666

THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF MOLYBDENUM AND TUNGSTEN. M. J. Makin and E. Gillies (Atomic Energy Research Establishment, Harwell, Berks). J. Inst. Metals 86, 108-12(1957) Oct.

The changes in mechanical properties of stress-relieved Mo and fully recrystallized W after irradiation at 100°C with 5 × 10^{19} neutrons/cm^2 have been studied at a variety of temperatures, and from these tests the influence of irradiation on the ductile → brittle transition temperature has been found. The yield stress of Mo was increased by irradiation at all testing temperatures between 20 and 200°C, the increase being greater the higher the temperature. A marked yield point was developed in irradiated Mo after an anneal at 200°C for 60 min, suggesting migration to, and anchoring of, dislocations by vacancies produced during irradiation. The elongation before fracture was reduced by the irradiation. The ductile → brittle transition temperature of Mo was raised from −136 to −73°C by irradiation, in marked contrast to the small rise (from 118 to 126°C) in the transition temperature of fully recrystallized W after an equal neutron dose. It is concluded that the magnitude of the increase in transition temperature due to irradiation is very dependent upon the initial transition temperature, being greater the lower the initial value. (auth)

667
THE HARDENING AND EMBRITTLEMENT OF STEEL BY IRRADIATION WITH NEUTRONS. A. T. Churchman (Associated Electrical Indistries, Ltd., Aldermaston) and I. Mogford and A. H. Cottrell (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 1271-5(1957) Oct.

The tensile yield and fracture strengths of a structural steel have been measured before and after irradiation with neutrons. The fracture strength increases with irradiation at the same rate as the yield strength and the embrittlement cannot be ascribed to a loss of cohesive strength. Measurements have been made of the effects of grain size and testing temperature on the yield and fracture strengths; applied to Petch's equation they show that the radiation hardening is caused essentially by an increase in 'frictional' resistance in the slip planes, such as would be produced by dispersed islands of radiation damage, and that the cohesive strength of the lattice and the dislocation locking stress are not detectably changed by the irradiation. Notched-impact tests have also been made to show the embrittling effect of the irradiation. (auth)

668
EFFECTS OF X-RAY IRRADIATION ON THE FREQUENCY-TEMPERATURE BEHAVIOR OF AT-CUT QUARTZ RESONATORS. A. R. Chi (U. S. Army Signal Corps Engineering Labs., Fort Monmouth, N. J.). Phys. Rev. 107, 1524-9 (1957) Sept. 15.

Results of an investigation of the effects of x-ray irradiation on AT-cut resonators fabricated from natural quartz, synthetic quartz grown on several different cuts of seed plates, and synthetic quartz containing aluminum or germanium as an impurity are reported. The differences in the frequency-temperature characteristics of AT-cut resonators fabricated from natural quartz and all synthetic quartz investigated are known. These differences are nullified by x-ray irradiation of all the synthetic quartz except one which contains germanium. The effect of x-ray irradiation can be removed by thermal bleaching at temperatures between 200 and 500°C for a few hours. The thermal-bleaching temperature is different for different types of quartz. (auth)

669
EXCITATION OF X RADIATION FROM Ni, Cu, AND Mo BY Po^{210} ALPHA PARTICLES. Wolfgang Bühring and Otto Haxel (Univ. of Heidelberg). Z. Physik 148, 653-61(1957). (In German)

670
THE STRUCTURAL DEFECTS IN GERMANIUM MONOCRYSTALS IRRADIATED BY BETA PARTICLES AND FAST NEUTRONS, AND THE INFLUENCE OF THESE DEFECTS ON ELECTRON-HOLE RECOMBINATION. Presented at the International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/197a. V. S. Vavilov, L. S. Smirnov, A. V. Spitzin, V. M. Patskevitch, and M. V. Chukichev. London, Pergamon Press, Ltd., 1957. 10p.

671
ENERGY OF IONIZATION BY BETA-PARTICLES IN CRYSTALS OF GERMANIUM AND SILICON. Presented at International Conference on Radioisotopes in Scientific Research, Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/197b. V. S. Vavilov, L. S. Smirnov, and V. M. Patskevitch. London, Pergamon Press, Ltd., 1957. 4p.

Radioactivity

672 AEC-tr-3054
CONTENT OF NATURAL RADIOACTIVE SUBSTANCES IN THE ATMOSPHERE AND IN NATURAL WATERS IN THE TERRITORY OF THE U.S.S.R. E. K. Fedorov and V. I. Baranov, eds. Translated from a publication of the Academy of Sciences, U. S. S. R., Moscow, 1956. 24p.

Systematic research has been and is being carried out in the U.S.S.R. on the radioactivity of natural waters. There has been no systematic study of the natural radioactivity of the air, although some measurements have been taken in connection with various geophysical projects. Available data on the natural radioactivity of waters and the atmosphere are summarized. (C.H.)

673
COSMIC-RAY-INDUCED RADIOACTIVITY IN METEORITES AND TEKTITES. Presented at International Conference on Radioisotopes in Scientific Research held Sept. 9-20, 1957 at Paris. No. UNESCO/NS/RIC/219. T. P. Kohman and W. D. Ehmann. London, Pergamon Press, Ltd., 1957. 20p.

674
THEORY OF ALPHA DECAY (ESPECIALLY NUCLEI IN THE REGION OF Pb^{208}). Hans Jörg Mang. Z. Physik 148, 582-92(1957). (In German)

Rare Earths and Rare-earth Compounds

675
INTERACTION OF CERIUM WITH HYDROGEN. V. I. Mikheeva and M. E. Kost (Kurnakov Inst. of General and Inorganic Chemistry). Doklady Akad. Nauk S.S.S.R. 115, 100-2(1957) July 1. (In Russian)

Prepared specimens of 97% Ce with 2.9% Nd and Pr were used in determining the volume of hydrogen combined with Ce. The hydrogen content was determined by evaluation of the amount of hydrogen absorption (the drop in pressure of the system), by weighing the metallic Ce, and by determination of the volume of hydrogen recovered in hydride dissolved in dilute hydrochloric acid. The order of error was ± 2% of the determined value. After careful purification of the initial material, the hydridation of the metallic Ce takes place at room temperature without any preliminary thermal treatment of Ce. The hydride CeH_3 is obtained at room temperature (14 to 21°) regardless of the hydrogen pressure. The diagram showing the dependence of hydride content on the temperature and the diagram of the rate of hydridation confirm the formation of CeH_2 and CeH_3 and the appearance of the interchanging phase between CeH_2 and CeH_3. (R.V.J.)

676
IDENTIFICATION OF INTERNAL CONVERSION SPECTRA FOR THE LONG-LIVED ISOTOPES Eu^{152} AND Eu^{154}. B. V. Bobykin and K. M. Novik. (Physico-Technical Inst., Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 115, 263-6(1957) July 11. (In Russian)

Shielding

677 AERE-RE/R-1406
Gt. Brit. Building Research Station, Garston, Watford, Herts, England.
CONCRETE OF HIGH DENSITY FOR SHIELDING ATOMIC REACTORS. Feb. 1954. Decl. July 2, 1957. 20p. (BRS-DR-40).

A program of tests and development work on concrete for use in shielding atomic reactors was undertaken. Concretes made with river gravel barytes and steel shot aggregate were tested. Determinations were made of density, hydrogen content, strength, and thermal conductivity. Data are tabulated. (auth)

678 IGRL-IB/R-30

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

RADIATION SHIELDING. Information Bibliography. Sept. 1957. 14p.

This selection of references is primarily for information on reactor shielding and its design. Sources searched were U.K., Canadian, and U.S. report abstracts, Nuclear Science Abstracts, Engineering Index (1950-1955), and Industrial Arts Index (1956). (auth)

679 NAA-SR-1921

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE THEORETICAL CALCULATION OF THE ATTENUATION OF GAMMA RADIATION FROM A SWIMMING POOL TYPE REACTOR. R. L. Ashley and D. S. Duncan. Aug. 15, 1957. 40p. Contract AT-11-1-GEN-8. $1.25(OTS).

In order to determine the adequacy of the calculational methods employed by Atomics International to solve shielding problems on such reactor systems as the SRE and OMRE, it is required that the results obtained by using these methods be compared with accurate experimental information. Since the only reactor on which such experimental data is available is the Oak Ridge Bulk Shielding Reactor, the theoretical attenuation of gamma radiation in the BSR shield was evaluated. The results were compared with the measurements of the gamma-ray attenuation from this reactor out to a distance of 700 cm from the core. The analysis performed indicates that it is possible to reproduce the measured data quite accurately over the entire range of water thickness for which measurements have been made, the average value of the calculated to measured dose rates being 1.25 with the maximum deviation from this value being less than 19%. The formulation and assumptions necessary in the analysis are discussed. It is concluded that the spectra and method used will yield results which are more than adequate when dealing with shielding analyses, per se, and are probably adequate for heat generation problems as well. (auth)

Spectroscopy

680

A ROBOT DEVICE FOR MEASUREMENT OF ANGULAR DISTRIBUTIONS WITH HIGH ENERGY RESOLUTION. Curt Mileikowsky. Arkiv Fysik 12, 353-7(1957).

The spectrometer is turned by an electric motor which operates on the periphery of the large circular iron table on which the spectrometer is mounted. Two microswitches which can be moved along the periphery to any position will stop the motor when the table comes into the desired position. As the diameter of the table is about two meters one will get repeatedly accurate angle positions. The changing of the magnetic field is simply achieved with a relay that chooses between two alternative settings of the electronic regulator and between two settings of the precision compensator which is used for measuring the field. The changing of the photographic plate is intended to be obtained later on with a mechanical device. The exposure time is determined by contactors on a circular disc driven by a synchronous motor. The contactors connect a relay which is intended to operate a commercial shutter from an ordinary camera placed between the target and the spectrometer. The exposure time will be 300 sec. One sixth of the periphery of the timing disc is reserved for the time period when the spectrometer is turned and the changing of magnetic field and photographic plate takes place. The whole cycle of operations is represented. The circuit diagram of the device is shown. (auth)

681

ON RELATIVE INTENSITY MEASUREMENTS WITH A TWO-DIRECTIONAL FOCUSING β-SPECTROMETER WITH ENERGY-DEPENDING WINDOW CURVE. Karl-Erik Bergkvist (Nobel Inst. of Physics, Stockholm, Sweden). Arkiv Fysik 12, 381-97(1957).

It is shown that intensity determinations are rather insensitive to changes in the window curve both when comparing intensities of conversion lines and when measuring the shape of a continuous β-spectrum. A simple method is given to reduce the weak energy dependence present. The results obtained are experimentally tested. (auth)

682

ULTRAVIOLET SPECTRA OF LiH AND LiD. R. Velasco (National Research Council, Ottawa, Can.). Can. J. Phys. 35, 1204-14(1957) Oct.

The absorption spectra of LiH and LiD have been observed in the near ultraviolet with high dispersion and absorbing path lengths up to 16 meters. A new band system has been found in each molecule involving the ground state and a $^1\Pi$ excited state. Rotational and vibrational analyses of this system have been carried out and rotational and vibrational constants for the upper state have been determined. The observed breaking off of the rotational structure of the bands of this $B\ ^1\Pi - X\ ^1\Sigma^+$ system has been interpreted as due to predissociation by rotation. With this assumption very accurate dissociation limits of the $B\ ^1\Pi$ state have been obtained. From these dissociation limits the dissociation energies of the three known electronic states of LiH and LiD have been calculated. In particular the dissociation energies (D_0) of the ground states of LiH and LiD have been found to be 2.4288 ± 0.0002 ev and 2.4509 ± 0.0010 ev, respectively. (auth)

683

ISOTOPE SHIFT IN THE RESONANCE LINES OF Mg I. F. M. Kelly (Univ. of Manitoba, Winnipeg). Can. J. Phys. 35, 1220-2(1957) Oct.

Measurements of the isotope shift in $\lambda 2852$ ($3\ ^1S_0 - 3\ ^1P_1$) and $\lambda 4571$ ($3\ ^1S_0 - 3\ ^3P_1$) of Mg I are reported. The new measurements are compared with other results and with theoretical calculations. (auth)

684

MEASUREMENT OF HYPERFINE STRUCTURE OF KF BY THE MOLECULAR BEAM RESONANCE METHOD. Christoph Schlier. Z. Physik 147, 600-27(1957). (In German)

The hyperfine structure of KF molecules was measured by the molecular beam resonance method. The apparatus used is described. (auth)

Uranium and Uranium Compounds

685 AECD-4247

[Los Alamos Scientific Lab., N. Mex.]

SOLDERING OF URANIUM. G. S. Hanks, D. T. Doll, J. M. Taub, and B. L. Brundige. [1957?]. Decl. Sept. 23, 1957. 30p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00 (mf OTS).

The joining of U to U was done successfully using a number of commercial soft solders and fusible alloys. Soldering by using an ultrasonic soldering iron has proven the best method for making sound soldered joints of U to U and of U to other metals, such as stainless steel. Methods of soldering, other than the ultrasonic procedure, have shown some promise but did not give reliable joints all of the time. The soldering characteristics of U may best be compared to those of Al. (auth)

686 HW-51168

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PROGRESS REPORT ON EXPERIMENTS TO DETERMINE

INFINITE MULTIPLICATION FACTORS OF ENRICHED UO_3-H_2O MIXTURES. Harry E. Handler. July 1, 1957. Decl. Aug. 26, 1957. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Experiments to determine maximum U^{235} enrichment for UO_3-H_2O and $UO_2(NO_3)_2-H_2O$ mixtures which will be subcritical independent of the H/U ratio and the volume are described. (T.R.H.)

687

SUPERCONDUCTIVITY OF URANIUM. R. A. Hein, W. E. Henry, and N. M. Wolcott (U. S. Naval Research Lab., Washington). Phys. Rev. 107, 1517-20(1957) Sept. 15.

A ballistic mutual-inductance technique has been employed to investigate the magnetic susceptibility of two U samples down to a temperature of 0.1°K. Both samples exhibited a superconducting transition in zero magnetic field at a temperature (T_c) of 0.68 ± 0.02°K. The transitions were not sharp, being spread over a temperature interval of 0.45°K. The critical magnetic field of one of the samples was measured down to 0.37°K and a value of 720 gauss/deg was obtained for $(dH/dT)T = T_c$. Consideration is given to the values of the electronic specific heat coefficients derived from the critical magnetic field data for U and Ti. (auth)

688

CALORIMETRIC DETERMINATION OF THE AVERAGE TOTAL KINETIC ENERGY OF FRAGMENTS FROM FISSION OF U^{235}. S. R. Gunn, H. G. Hicks, H. B. Levy, and P. C. Stevenson (Univ. of California, Livermore). Phys. Rev. 107, 1642-5(1957) Sept. 15.

The average kinetic energy of the fragments from thermal neutron fission of U^{235} has been redetermined calorimetrically; a value of 166 ± 2 Mev is obtained, in excellent agreement with other measurements. The calorimeter and the method of correction for beta absorption are described. The number of fissions occurring in the samples was determined by a Mo^{99} radiochemical analysis which is described in detail. An improved value for the half life of Mo^{99}, 66.00 ± 0.15 hr, has been determined. (auth)

PATENTS

Engineering

689

INJECTOR PUMP FOR CONVEYING LIQUIDS. J. D. Thornton (to U. K. Atomic Energy Authority). British Patent 774,130. Nuclear Eng. 2, 408(1957) Sept.

In order to avoid moving parts the liquid is pumped through an injector arranged below the surface and is pulsated so that the surface oscillates about a mean position. During the positive half-cycle of a pulse, liquid is forced through the injector nozzle so that the liquid is pumped from the main intake to the injector outlet. During the negative half-cycle the liquid flows in reverse without pumping action. It is used for feeding liquid to an extraction column or mixer-settler tank against a static head in liquid-liquid extraction plants. (auth)

690

METHOD AND APPARATUS FOR DETECTING LEAKS IN PIPELINES. J. F. Cameron and S. Jefferson (to U. K. Atomic Energy Authority). British Patent 774,136. Nuclear Eng. 2, 408(1957) Sept.

A radioactive solution is injected into fluid flowing in the pipeline behind which a first squee-gee go-devil is introduced. After an interval sufficient to enable the non-radioactive solution to flush the inside of the line clear of radioactivity a second squee-gee go-devil is introduced with a radioactivity recording detector. This detector is recovered at a remote point and the record of any activity is then transcribed in terms of distance along the line. To check the distance, the record may be marked at intervals by arranging sources of radioactivity at certain points along the line which will make a characteristic signal. For penetrating thick metal pipes gamma radioactivity is necessary and detectors with Geiger counters or scintillation detectors. (auth)

Physics

691

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. British Patent 770,252. Mar. 20, 1957. Nuclear Power 2, 394(1957) Sept.

The thermal properties required of a heat transfer medium for reactors are high specific heat and thermal conductivity, low density and viscosity, low vapor pressure, high boiling point, and a capacity for absorbing and dissipating considerable quantities of heat without developing high pressure. No substance has optimum values of all these properties but lithium compares very favorably with all others. Lithium is also a good moderator and its radioactive isotopes have very short half lives. However, natural lithium contains 7% Li^6, which has a very large absorption cross section for thermal neutrons. This invention provides a transfer medium containing substantially less than 7% of Li^6 and suggests that at 0.03% by weight, the medium has neutron absorption comparable to sodium. Apparatus suitable for reducing the Li^6 content consists of two graphite electrodes in a U-tube filled with fused lithium chloride at 650°C, with tightly packed quartz powder between the cathode and anode spaces to serve as a diaphragm. A current density of 9 amps/sq cm is passed through. Chlorine is given off at the anode and removed, and chlorine is introduced into the cathode space. Lithium chloride with a reduced Li^6 content is obtained in the anode space, while the lithium in the cathode space is enriched with Li^6. (auth)

692

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENT CHARGING/DISCHARGING GEAR FOR NUCLEAR REACTORS. E. Long (to United Kingdom Atomic Energy Authority). British Patent 772,702. Apr. 17, 1957. Nuclear Power 2, 394(1957) Sept.

In the Calder Hall reactors, to reduce the number of standpipes through which fuel is loaded into the 1,696 core channels, the latter are grouped in 16's with a single charge tube serving each group. Since the elements thus approach the channels obliquely, means have to be provided to guide them in without damage to the graphite core or the element. The devices used at Calder to do this are known as charge guides or pans and this is the patent covering them. The guide is a nodular iron casting with a 4 × 4 array of tapered holes corresponding with a fuel channel group. The holes are 11 in. long and taper from 5 in. to 5.92 in. diam. Support of the guides on the top of the graphite core is at three points since thermal movements of the blocks are to be expected during the reactors' lifetime. Location is centered on a 17th channel at the center of the guide which serves the control rod hole and which also receives the snout of the charging machine. The tapered holes of the charge pan are each fitted with an entry for the burst slug detection gear 'sniffer' pipes. It is stated that these guides weigh 600 lb. (auth)

693

NUCLEAR REACTOR ELEMENTS. (To Brown, Boveri and

Co. Ltd. (Switzerland)). British Patent 773,021. Nuclear Eng. 2, 408(1957) Sept.

The elements, rods or tubes of U, are surrounded by a closely fitting and completely closed sheath filled with an intermediate material consisting of 44.5% Pb and 55.5% Bi (by weight) with a melting point of 125°C. This material is liquid at the operating temperature and produces a good heat transmission between the fissionable material and the sheath. (auth)

694

MANUFACTURE OF ELECTRIC CABLES. L. G. Brazier and R. M. Black (to British Insulated Callendar's Cables Ltd.). British Patent 773,563. Nuclear Eng. 2, 408(1957) Sept.

The dielectric around the conductor is a laminated body built up from strips of insulating material impregnated with a liquid organo polysiloxane which gels after completion of the impregnation when subjected to high energy radiation. Suitable polysiloxanes are the poly-dimethyl-silicone oils. The high energy radiation may be carried out in a nuclear reactor and consists then of slow neutrons with associated fast neutrons and gamma rays of an intensity of not less than 10^{14} thermal neutrons/cm^2-min. (auth)

695

METAL SHEATHING OF SOLID BODIES. W. O. Alexander (to U. K. Atomic Energy Authority). British Patent 773,771. Nuclear Eng. 2, 408(1957) Sept.

Uranium rods or slugs are introduced into tubular metal containers Al alloys with Mn (up to 2%) or Mg (up to 5%) of a wall thickness of 0.01 to 0.03 in. The container may be open on both ends or on one end only. The open ends are turned over around the rod or slug body and also around the head of a rivet backing on the body. The closure is produced by riveting the shank of each rivet over the turned-in end. To obtain a close fit of the sheath, the container may, after introduction of the body, be reduced by cold drawing, pressing or otherwise. The body (uranium rod) is preferably of cylindrical form with plain ends from 3-in. to 12-in. length and 1-in. diam. and is fine machined. To minimize danger of escape of fission products, a double sheath may be employed. (auth)

696

METHOD AND DEVICE FOR THE PRODUCTION OF ENERGY FROM EXOTHERMAL CHEMICAL OR NUCLEAR REACTIONS. P. Schmidt (Germany). British Patent 774,052. Nuclear Eng. 2, 408(1957) Sept.

Conversion of substances, e.g., of hydrogen into helium, requires extremely high temperatures and pressures. The new method produces such temperatures and pressures by pressure shock waves with a comparatively limited technical equipment. These shock waves occur in detonations and in the movement of bodies and gases in the supersonic range and their use for this method is based on the discovery that the energy embodied in the shock wave and progressing with it is concentrated to higher temperatures and pressures when the shock waves converge. Observations made in the investigation of pressure waves show that the compressibility of water at pressures of over 50,000 kg/cm^2 is much higher than would be expected from an extrapolation of the static values measured at low pressures, and that a crushing of the atomic electron shells is commencing. In the range of extremely high concentrations of the energy of pressure shock waves the nuclei are liberated and nuclear conversion occurs. The method is carried out in a hollow sphere filled with an elastic compressible medium (hydrogen). Pressure waves are produced in quick succession in the form of concentric spherical waves meeting at the center of the hollow sphere. For a sphere diameter of 2 m and radial impulse velocities of 10 to 100 m/s and only small pressure increments, temperatures in the center of the sphere are calculated to reach 10^8 to 10^9 °K. (auth)

697

COLD SEPARATION OF GAS MIXTURES. R. Spondlin, L. Stouls, H. Bonnaud, and G. Simonet (to Commissariat à l'Energie Atomique (France)). British Patent 774,255. Nuclear Eng. 2, 408(1957) Sept.

The invention is shown in an application for the purification of hydrogen containing small amounts of nitrogen, in an installation for manufacturing deuterium by liquefaction and rectification. (auth)

698

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. F. W. Fenning and R. F. Jackson (to United Kingdom Atomic Energy Authority). British Patent 779,134. July 17, 1957. Nuclear Power 2, 394(1957) Sept.

Very long and detailed, this is the full specification for Harwell's famous air-cooled reactor BEPO which first went critical in 1948. Since the date of application is nearly four years after the pile first went into operation the specification represents it in actuality, these being only one claim. (auth)

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IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. R. V. Moore and G. Packman (to United Kingdom Atomic Energy Authority). British Patent 779,408. July 17, 1957. Nuclear Power 2, 394(1957) Sept.

As in now well known, the charge in a Calder Hall fuel element channel consists of six magnesium-canned uranium bars stacked one above the other: this patent gives more details. A basic idea of the invention is the preferential cooling of parts of fuel element cans which are subject to high gravity stresses from the vertical stacking arrangement. This allows a higher temperature and greater output. Build up of heat by conduction from element to element is induced by the inclusion inside the cans of a dish of magnesium oxide. In this way the parts of the fuel cartridges subjected to high stresses are kept at relatively low temperatures. Various minor alternative arrangements are included in the specification. It should be noted that recently, owing to the so called 'Cottrell creep,' it was found that the lower elements at Calder were tending to bow in the middle. This has been cured by fitting some kind of additional spider in the center of the affected elements. (auth)

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IMPROVEMENTS IN NUCLEAR REACTORS PROVIDED WITH A NEUTRON FLUX MEASUREMENT DEVICE. (To Commissariat à l'Energie Atomique.) British Patent 780,219. July 31, 1957. Nuclear Power 2, 394(1957) Sept.

Measurement of low level neutron flux in a reactor is difficult partly because of gamma emission following shutdown, and partly because the measuring apparatus has to be so near the reactor that it is liable to be destroyed when the reactor starts up again. This invention aims to overcome these drawbacks by interposing between the core and the measurement device, which may be of any type, a shield, preferably of bismuth, which has a high mass coefficient for gamma rays, low neutron cross section and does not cause secondary gammas. For normal operation, when flux levels are high, a retractable shield can be interposed between the bismuth shield and the reactor. This must have a large neutron cross section and must give rise to practically no secondary gammas. Boron is the preferred material for this. The measuring instrument has two calibrations corresponding to the two positions of the retractable shield. (auth)

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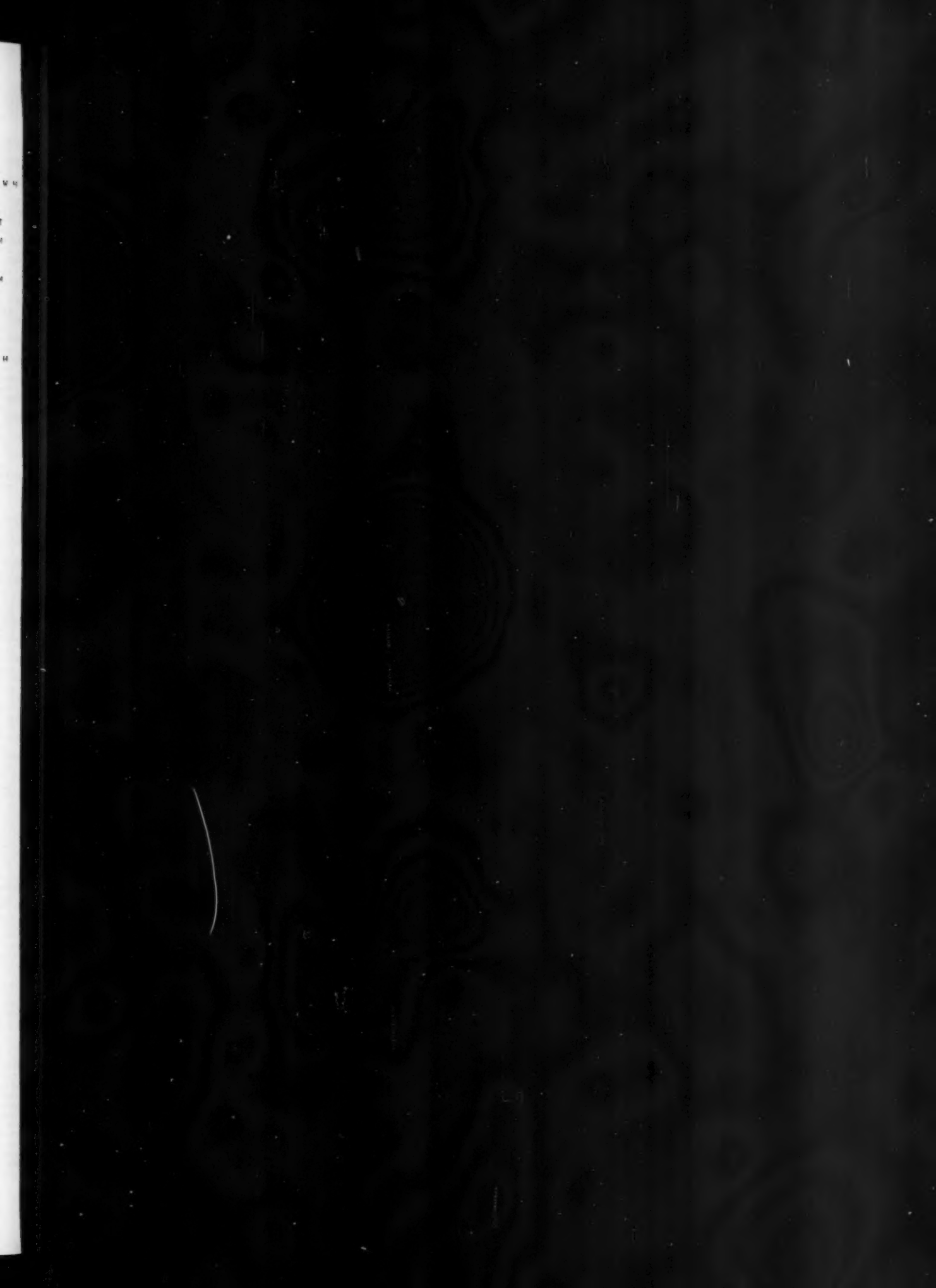

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